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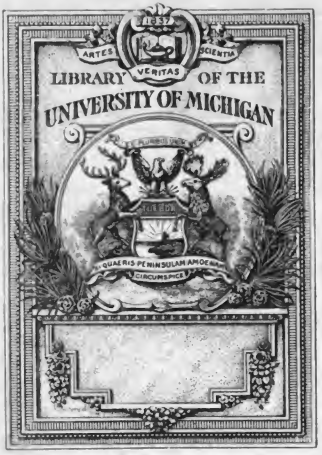
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REAGENTS AND REACTIONS

KNOWN BY THE NAMES OF THEIR AUTHORS.

BASED ON THE ORIGINAL COLLECTION BY

A. SCHNEIDER,

Revised and enlarged by

DR. JULIUS ALTSCHUL,

for the Pharmaceutische Centralhalle.

TRANSLATED FROM THE GERMAN

BY

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Instructor in Pharmacy at the University of Wisconsin.

MILWAUKEE, WIS.
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Reagents and Reactions known by the Names of their Authors.*

Based on the original collection by *A. Schneider*, revised and enlarged by Dr. *Julius Altschul.*

Eleven years ago *A. Schneider* published in the Pharmaceutische Centralhalle a collection of reagents and reactions known by the names of their authors. This compilation was printed in No. 35 of the year 1885 after it had been published in somewhat abbreviated form in the Pharmaceutischer Kalender for 1885, which appeared in 1884. This first attempt at an alphabetical compilation of reagents and reactions commonly and only semi-occasionally known by the names of their authors met an undeniable demand. The number of such reactions and corresponding reagents, especially for qualitative tests, is constantly growing. In the study of chemical literature the reader frequently loses the significance of a reference to such reagents or reactions because he is not familiar with the name of the author, which stands for the chemical synonym, or cannot readily find the necessary literary reference. The following list is to assist the reader in such emergencies. That the original list filled a gap in chemical literature was clearly demonstrated by the fact that the edition of that number of the Centralhalle, al-

* Translated for the Review from the original in Nos. 28 and 29 of the Pharmaceutische Centralhalle, 1896.

though larger than usual, was rapidly sold, and also by the numerous reprints. The original list also led to the preparation of new lists, of which might be mentioned the collection of *Julien Delaite*, Luettich, 1892; that of *Alberto Janssen*, Florenz, 1894; of Dr. *C. Duennenberger*, Zuerich, 1894; and of *Schneller*, Eichstaett, 1894.

In none of these collections is any reference made to the original list of Schneider. From a note in *Krauch's* Prüfung der chemischen Reagentien, III. Auflage, p. 394, in which the work of Dr. Duennenberger and of *Ferdinand Jean* et *G. Mercier*, Repertoire des réactifs spéciaux, généralement désignée sous leurs noms d'auteurs, Paris, 1896, is mentioned without a reference to the collection of Schneider, it seems apparent that the original has been forgotten. The Pharmaceutische Centralhalle has therefore seen fit to publish a revised list based on the original one of 1885, in which the more recent literature is duly considered. The growth of this literature is readily indicated by the fact that the list published in 1885 contained about 200 articles (Dr. Duennenberger's list contains 350), whereas the present list contains over 600 articles and cross references. The author does not even now claim completeness for his list, but hopes that in its new form it may prove a serviceable adjunct both in study and laboratory practice.

As far as the selection of material is concerned stress has been laid principally on qualitative reactions. Quantitative tests have been added only in so far as they serve also for qualitative determination. Most of the items belong to the technical, pharmaceutical and physiological branches of chemistry. Of bacteriological reagents only a few of the most important were added.

The author has taken special pains to call attention, by means of cross references, to relations existing between different reactions, and particularly to the numerous modifications of some of the more important reactions. An index is added to facilitate the use of the collection.

Adamkiewicz' reaction for albumen. The acetic acid solution of albumenous substances is colored violet upon the addition of concentrated sulphuric acid, and possesses a greenish fluorescence. The same reaction results if the albumen is treated with a mixture of 1 vol. of concentrated sulphuric acid and 2 vol. of glacial acetic acid. The reaction is facilitated by the application of heat, also, according to *Wurster*, by the addition of a few grains of sodium chloride.

Agostini's reaction for glycose. If to 5 drops of the urine to be examined 5 drops of ½ p. c. gold chloride solution and 3 drops of 20 p. c. potassa solution are added, and the mixture is gently heated the presence of sugar in the urine will be indicated by the formation of a red color.

Allen's reaction for vegetable fats. Equal volumes of fat and nitric acid, sp. gr. 1.4, are shaken for ½ minute and then set aside for 15 minutes. The presence of vegetable fats (cotton-seed oil) is indicated by the formation of a coffee-brown color.

Allen's reaction for phenol. With hydrochloric and nitric acids phenol produces a carmine-red color.

Almén's reagent for blood. A liquid containing blood, when well shaken with a mixture of equal parts of guaiac tincture and turpentine oil, becomes blue owing to the precipitation of guaiac resin. The color is permanent to heat. See also *Weber* and *Schoenbein*.

Almén's tannin solution serves as a precipitant for albumen. It consists of a solution of 4 grams tannin, 8 ccm. of 25 p. c. acetic acid and 190 ccm. of 40 to 50 p. c. alcohol. It also precipitates nucleoalbumin.

Almén's reagent for glucose is prepared by digesting 2 grams of basic carbonate of bismuth with 100 ccm. potassa solution, sp. gr. 1.33, and 4 g. Rochelle salt. Upon cooling the clear solution is decanted from the precipitate. 1 ccm. of the reagent is boiled for several minutes with 10 ccm. of urine. If glucose is present a yellowish-brown precipitate results, which becomes darker and finally black.

This reagent is also known as the *Boettger-Almén* reagent. Compare also *Nylander's* solution.

Anderson's reaction for distinguishing between chinoline- and pyridine salts. The chloroplatinates of the latter, when boiled with water, are converted into insoluble double salts with the elimination of hydrogen chloride, whereas the former remain in solution.

Arata's test for artificial dyestuffs in wine depends upon the observation that these dyestuffs are abstracted from the wine by means of wool. The fibre is then subjected to special reactions.

Arndt's determination of sugar by means of the ferment saccharometer. See *Einhorn*.

Arnold's reactions for alkaloids.

I. Some alkaloids when heated on the water-bath with syrupy phosphoric acid, obtained by dissolving metaphosphoric acid or phosphoric acid anhydride in officinal phosphoric acid (Ph. G. III), produce characteristic color reactions: aconitine —violet; nicotine—yellow; coniine—green.

II. Triturated with conc. sulphuric acid, many of the alkaloids yield characteristic color reactions upon the addition of conc. 30 to 40 p. c. alcoholic (in some instances aqueous) potassa solution.

III. *Arnold-Vitali's* reaction. A small quantity of alkaloid is triturated with conc. sulphuric acid and a grain of sodium nitrite is added; then as in II. strong potassa solution. A number of alkaloids produce characteristic color reactions. Thus e. g. atropine and homatropine produce with sulphuric acid and sodium nitrate an orange-yellow color which upon the addition of the potassa becomes reddish-violet and fades to rose-red.

Arnold's reaction for narceine. Upon heating a substance containing narceine with conc. sulphuric acid and a trace of phenol a reddish color is produced.

Axenfeld's reagent for albumen is a 0.1 p. c. solution of chloride of gold. The solution to be tested is acidulated with formic acid and heated with a drop of the reagent. If albumen is present the solution becomes purplish, upon the addition of more gold chloride, blue. The latter color reaction is also produced by glucose, starch, tyrosine, lencine, etc., but the purplish color is characteristic for albumen.

Aymonier's reaction for α-naphthol. The 15 p. c. alcoholic solution of α-naphthol is colored violet upon the addition of cane sugar and mixing with 2 vol. sulphuric acid. Upon the addition of one drop of a mixture of 1 p. potassium bichromate, 10 p. water and 1 p. conc. nitric acid the same α-naphthol solution yields a black precipitate. β-naphthol does not produce either of these reactions.

Bach's reagent for hydrogen peroxide, consists of the following solutions:

a) 0.03 potassium bichromate and 5 drops of aniline in 1 liter of water;

b) 5 p. c. oxalic acid solution.

5 ccm. of the solution to be tested, when shaken with 5 ccm. of solution a) and 1 drop of

solution b), yields a violet-red coloration when hydrogen peroxide is present.

Barbot's reagent for fatty oils is fuming nitric acid. When mixed with this reagent different oils show different behavior with regard to coloration and solidification. Olive oil, for example, yields a white (not red or brown) mixture which solidifies after 1 to 2 hours.

Barfoed's reagent for glucose is either a solution of 14 g. crystallized copper acetate in 200 ccm. water and 5 ccm. acetic acid, or, according to a more recent formula, of 0.5 copper acetate in 100 ccm. water and 1 ccm. acetic acid. Glucose reduces this solution in the cold, more quickly upon heating. Dextrin, cane sugar and milk sugar do not reduce the solution. It is used for the distinction between glucose and lactose in urine.

Barreswil's reagent for glucose corresponds to Fehling's solution, but contains potassa in place of soda.

Basoletto's reagent. A mixture of equal parts by volume of sesame oil and a 2 p. c. solution of cane sugar in hydrochloric acid, sp. gr. 1.124, is colored red in the cold, but more rapidly upon heating. With glucose and lactose the color is produced only when the mixture is boiled with the hydrochloric acid and allowed to cool. Compare Baudouin's test.

Baudouin's test for sesame oil. The reagent consists of 0.1 g. sugar dissolved in 10 ccm. hydrochloric acid, sp. gr. 1.18. One volume of this solution is shaken with 2 vol. of the oil to be tested. If sesame oil is present the oil upon separation is cherry-red.

According to *Lewin* the reaction is carried out as follows: 0.5 g. of finely pulverized sugar in a test tube is covered with 2 ccm. of the oil, then 1 ccm. of hydrochloric acid, sp. gr. 1.18, is poured carefully down the sides of the tube. If sesame oil is present a rose-red zone is formed within 1 to 5 minutes.

According to *Millian*, *Baudouin's* test is more delicate when carried out with the well dried free fatty acids, which have been obtained from the oil.

Villavecchia and *Fabris* (q. v.) replace sugar and hydrochloric acid by furfurol. Compare also *Carlinfanti*, and *Gassend*.

Baumann's reagent for polyatomic alcohols and diamines is benzoylchloride added to the solution of the alcohol or amine in aqueous soda.

Insoluble benzoyl esters are precipitated. Used for the detection of glycerine, carbohydrates and various products of bacterial activity in urine.

Bayer's reaction for indol. A solution of indol yields upon the addition of dilute nitric acid and dilute solution of potassium nitrite solution a red color or precipitate.

Beale's creosote mixture for imbedding microscopic preparations. To a solution of 180 g. methyl alcohol and 11 g. creosote sufficient chalk is added to make a thick paste. While constantly stirring 1920 g. of water are gradually added, then a few fragments of camphor. After standing several weeks the mixture is filtered.

Bechi's test for cottonseed oil. Upon heating with an alcoholic-ethereal silver nitrate solution cottonseed oil (eventually upon addition of colza oil) yields a reddish-brown color; olive oil and other oils remain uncolored. The Swiss Society for Analytical Chemists in 1895 suggested the following reagent: to 1 g. silver nitrate, dissolved in 5 ccm. of water, 200 ccm. alcohol, 20 ccm. ether and 1 ccm. nitric acid, sp. gr. 1.4, are added. In order to test for cottonseed oil, 10 ccm. of the fat and 3 ccm. of the reagent are mixed and the mixture heated on a boiling water-bath for 10 minutes. If cottonseed oil is present the mixture becomes brown or even black. Compare *Millian's* reaction.

Becker's reaction for picrotoxine. The alkaloid reduces Fehling's solution when gentle heat is applied.

Behren's test for fatty oils. When treated with a mixture of equal parts of sulphuric acid, sp. gr. 1.835 to 1.84, and nitric acid, sp. gr. 1.3, different oils show different behavior. Sesame oil produces a green color.

Beissenhirtz's reaction for aniline. If to a solution of aniline in conc. sulphuric acid a grain of potassium bichromate is added, the solution first becomes red, then blue, the color gradually disappearing.

Berthelot's alcohol reaction. If a dilute solution of alcohol is shaken with a few drops of benzoyl chloride and soda solution until the odor of benzoyl chloride disappears, the peculiar odor of ethyl benzoate is formed.

Berzelius' test for albumen. Metaphosphoric acid in freshly prepared concentrated solution pre-

cipitates all albuminous substances (except peptone) from their aqueous solutions.

Bettendorf's test for arsenic. A solution of stannous chloride in concentrated hydrochloric acid, sp. gr. 1.19. when heated with a solution of arsenic or arsenous acids in strong hydrochloric acid, yields a brownish turbidity or precipitate of metallic arsenic and tin. The presence of much sulphuric acid, of oxydizing or organic substances interfere with the reaction.

Bieber's reagent consists of equal parts of concentrated sulphuric acid, red nitric acid and water.

Biel's cocaine test. If a solution of 0.1 g. cocaine salt in 1 ccm. conc. sulphuric acid is heated for several minutes on a water-bath, the addition of several cubic centimeters of water causes the formation of a white, crystalline precipitate of benzoic acid.

Biltz's test for mono- and bicarbonate of sodium. When treated with mercuric chloride under certain conditions, these yield a white or respectively a brown precipitate.

Bischoff's reaction for gallic acid. When heated with dilute sulphuric acid and cane sugar gallic acid produces a red coloration. See also *Pettenkofer, Strassburg.*

Bischoff's melting-point test for butter. See *Drouot's test.*

Boas' reagent is a solution of tropæolin, or paper saturated with such solution.

Bodde's reaction for the distinction between resorcin and phenol, benzoic acid and salicylic acid. A solution of resorcin yields a violet color with sodium hypochlorite, which fades to yellow; with more hypochlorite solution and heat a yellowish-red or brown color is produced. If before the addition of the hypochlorite ammonia is added, a violet color is first produced, which changes to yellow and upon heating is converted into dark green.

Phenol, salicylic acid and benzoic acid yield a slight color with hypochlorite only upon heating. Upon previous addition of ammonia the acids are not colored.

Boedecker's test for albumen. If to a solution containing albumen (e. g. urine), which is acidulated with acetic acid, potassium ferrocyanide is added, a turbidity or flocculent precipitate is produced.

Boettger's (also *Boettcher's*) test for glucose. A dilute solution of glucose (or diabetic urine) is heated with a solution of sodium carbonate and some bismuth subnitrate or bismuth oxyhydrate. If reduction takes place the suspended bismuth compound is blackened. According to *Krueger* a stable reagent can be prepared by heating 15 g. bismuth nitrate, 15 g. tartaric acid, 75 g. water and the addition of sufficient aqueous potassa to effect solution, and some glycerin.

Boettger's test for the red color of wine consists in the addition of 1 vol. of concentrated copper sulphate solution to 3 vol. of wine diluted to ten times its volume. Pure red wine is thereby discolored. Unfermented wine as well as the coloring matter of bilberry, malva, cherries, also fuchsin remain unchanged or are colored violet.

Boettger's reagent for ozone. Filter-paper saturated with solution of gold chloride free from acid is colored violet by ozone. A test paper formerly suggested by *Boettger* contained thallium hydroxide, which was colored brown by ozone.

Boettger's test for sugar in glycerin. 5 drops of glycerin are heated to boiling with 100 drops of water, 1 drop of nitric acid, sp. gr. 1.3, and 0.03 to 0.04 gram ammonium molybdate. If sugar is present the solution is colored intensely blue.

Boettger's reagent for hydrogen peroxide. If to a solution containing hydrogen peroxide a solution of starch cadmium iodide and little ferrous sulphate is added, the blue color of starch iodide is produced. (Also known as *Schoenbein's* reagent.)

Boernstein's test for saccharin. The substance to be tested is extracted with ether. The extract, after the ether has been removed by distillation, is heated with resorcin and sulphuric acid. Then an excess of soda solution is added. If saccharin is present a strong fluorescence is produced. According to *Hooker* other substances, e. g. succinic acid, also produce this reaction.

Bohlig's reagent for ammonia. I. A solution of 1 p. mercuric chloride in 30 p. water. II. A solution of 1 p. potassium carbonate in 50 p. water. Free ammonia and that combined with carbonic acid produce a white turbidity with solulution I. If this reaction is first brought about upon the addition of solution II, the ammonia is combined with other acids.

Bonastre's reaction for myrrh. Strips of filter-paper are saturated with tincture of myrrh and after drying moistened with a drop of nitric acid. In the case of genuine myrrh a violet color is produced.

Borntraeger's aloe reaction. An alcoholic extract of aloes is shaken with benzin. The benzin solution after separation from the alcoholic layer and upon the addition of a trace of strong ammonia water is slightly heated while shaken. Aloes (also other substances, such as rhubarb, curcuma, galls, catechu) effect a violet coloration of the ammoniacal solution.

Bouchardat's reagent for alkaloids. (Iodine in potassium iodide.) 10 g. of iodine and 20 g. of potassium iodide are dissolved in 500 g. water. With the aqueous solution of most alkaloids this reagent produces reddish-brown precipitates.

Boudart's test for the distinction between fatty oils. The oils are mixed with nitric acid, sp. gr. 1.45 to 1.50. In the case of genuine cod liver oil carmine-red coloration is gradually produced.

Boudet's reagent for fatty oils is fuming nitric acid. Upon the addition of 5 p. c. of this acid olive oil becomes solidified. See *Barbot*.

Brand's reaction for quinine and quinidine. The salts of both alkaloids, triturated with a little chlorine water, are colored green upon the addition of ammonia. (Thalleiochin reaction.) If to the solution of the alkaloids, after the addition of a slight excess of chlorine water, ammonia water is added drop by drop, a green flocculent precipitate is first produced which dissolves with a green color in an excess of the ammonia water.

Brand's reaction for fluorine in beer. This is a modification of *Nivière's* test (q. v.) The fluorine in the precipitate is converted into hydrogen fluoride by means of sulphuric acid, and the former acid identified by means of its etching properties. For details see Zeitschr. f. d. ges. Brauwesen, 1895, p. 317.

Braeutigam-Edelmann's test for horse meat. 50 g. of the meat to be tested are boiled

with 200 g. of water for one hour. The filtered extract is evaporated to one-half its volume. After the albumen has been removed by means of dilute nitric acid, iodine water is added so as to form a layer. Horse meat, on account of its large percentage of glycogen, produces a burgundy-red zone. Starch and dextrin interfere with the reaction: the former producing a blue, the latter a red color.

Braun's test for glucose. A solution of glucose heated with a few drops of a solution of picric acid (1:20) produces a deep red coloration.

Braun's nitric acid reaction. Upon the addition of a small quantity of aniline sulphate and subsequently of concentrated sulphuric acid to a solution of a nitrate (or of free nitric acid) a violet-blue coloration results.

Bronardel and **Boutney's** reaction for the distinction between ptomaïnes and plant alkaloids. I. With potassium ferricyanide and ferric chloride ptomaïnes produce a blue color. II. With the aid of a quill and the solution of the alkaloid or ptomaïne some words are written on silver bromide paper. After the paper has been laid aside for ½ hour, protected against the light, it is developed with hyposulphite. In case of ptomaïnes the script appears black, but not in case of plant alkaloids. (Morphine also yields reaction I. [comp. *Kieffer's* reaction]; in fact none of the reactions based on the reducing properties can be considered characteristic.)

Bruecke's reaction for the coloring matter from bile. See *Gmelin's* reaction.

Bruecke's biuretreaction for albumenous substances. Coagulated albumen assumes a handsome violet color when treated first with dilute copper-sulphate solution, and, after removal of the excess of this reagent, with dilute soda solution. Comp. *Rose's* biuretreaction.

Bruecke's reagent for glucose. 5.5 g. freshly precipitated, moist bismuth subnitrate are boiled for 10 minutes with a solution of 30 g. potassium iodide in 100 g. water. Then 5 g. of 25 p. c. hydrochloric acid are added. Glucose (diabetic urine) effects reduction with formation of a brown or black coloration.

Brullé's test for foreign oils (cotton seed oil) in olive oil. 10 ccm. oil are boiled with 0.1 g. of pulverized albumen and 20 ccm. nitric acid. As soon as all of the albumen is dissolved, the genuine oil is almost colorless; upon cooling, turbid and straw-yellow. The color remains the same after standing 24 hours and the liquid solidifies. In the

presence of cotton seed oil the liquid becomes orange to brownish-red upon solution of the albumen. As a rule no solidification takes place.

Brunner's reaction for glucosides. Upon heating with bile and sulphuric acid a red color is produced (reversed *Pettenkofer's* reaction).

Buckingham's reagent for alkaloids is a freshly prepared solution of 1 g. ammonium molybdate in 16 g. of concentrated pure sulphuric acid. Heat is applied until the solution is clear. The reagent yields precipitates of different color with various alkaloids. Comp. *Hager*, Pharm. Praxis, I, 209.

Cailletet's reagent for fatty oils is a mixture of 12 parts phosphoric acid, sp. gr. 1.44, 7 parts sulphuric acid, sp. gr. 1.84, and 10 parts nitric acid, sp. gr. 1.37. According to other authorities it is nitric acid saturated with nitrous acid.

Cailletet's test for copper in oils. 10 ccm. oil are shaken with a solution of 0.1 g. pyrogallic acid in 5 ccm. ether. If copper is present a brown coloration and turbidity results.

Campani's reagent for glucose is a mixture of concentrated lead acetate solution with dilute copper acetate solution. Cane-sugar does not change the solution, glucose reduces the copper salt.

Capezznoli's reagent for sugar consists in the precipitation of ferric hydroxide with an excess of potassa solution. If sugar is present a dark orange-yellow ring is produced near the upper zone of the precipitate.

Caprauika's reaction for the coloring matter from bile. A solution of bromine in chloroform is added to the urine in question. In the presence of coloring matter from bile a greenish coloration is produced, which upon the addition and shaking with hydrochloric acid is conveyed to the acid.

Carlinfanti's modification of *Baudouin's* test (q. v.). After shaking the oil with the hydrochloric acid containing sugar the mixture is allowed to clarify. If sesame oil is present the hydrochloric acid appears purplish red. This color is permanent after the addition of three parts of water, whereas similar coloration, due to the presence of pure olive oil, disappears upon subsequent dilution.

Carpené's reagent for tannin (in wine) is a cold saturated solution of zinc acetate in 5 p. c. ammonia. Tannin causes a precipitation of this reagent.

Castle's reagent for bromine and iodine is dichlorbenzene sulphamide. The solid reagent or

its solution in chloroform is added to the solution of the halide. From iodides and bromides the haloides are liberated as with free chlorine and can be recognized by the color they impart to carbon disulphide or chloroform.

Cazeneuve's test for coal tar dyestuffs in wines. The wine is shaken with yellow mercuric oxide. The filtrate from natural wines is colorless. If aniline dyes are present it is distinctly colored.

Christen's reaction for albumen. Tannin produces a turbidity, respectively a precipitate with a solution of albumen.

Clarus' reagent for solanine is chromic acid solution, with which the alkaloid produces a sky-blue color.

Conrady's test for cane sugar (in milk sugar). 1 g. milk sugar is dissolved in 10 ccm. water; 0.1 g. resorcin and 1 ccm. hydrochloric acid are added and the mixture boiled for five minutes. In the presence of cane sugar a reddish coloration is produced.

Contejean's test for free hydrochloric acid in the stomach juice. A drop of the stomach juice is heated with cobaltic hydroxy-carbonate in a watchglass. If hydrochloric acid is present, cobaltic chloride is found, which colors the solution blue upon evaporation.

Cotton's phenol reaction. See *Lex's* reaction.

Crace-Calvert's reaction for fatty oils. The oils are treated with sulphuric acid and nitric acid of given concentration, or with phosphoric acid and nitro-hydrochloric acid and the color reactions are observed. Or the oils are treated with soda lye, either directly or after the addition of hydrochloric acid and changes in color and consistency observed. For detailed information see *Benedikt*, Analyse der Fette, II. Aufl., 307.

Creuse's test for salicin in quinine. Potassium bichromate and dilute sulphuric acid produce no change with quinine. If salicin is present the odor of salicylic aldehyde is produced.

Cronzel's test for vegetable and animal fats in vaselin. Upon trituration with permanganate solution the presence of such fats produces a brown coloration.

Cripp's and **Dymond's** test for aloes. 0.05 g. aloes or the corresponding residue left upon evaporation are triturated with 16 drops of concentrated sulphuric acid. Then 4 drops of nitric acid, sp. gr. 1.4, and 30 g. water are added. A coloration varying from orange to carmine is pro-

duced, which is darkened to a deep wine-red upon the addition of ammonia. (Rhubarb, senna, frangula interfere with the reaction.)

All aloines are precipitated by ferric chloride or lead acetate. Barbaloine and Nataloine are colored carmine-red by cold nitric acid, Soc aloin and Curaç aloin are colored red by fuming nitric acid.

Barbaloin, dissolved in a drop of concentrated sulphuric acid, is colored red upon the addition of nitric acid, Nataloin blue.

Dahlmann's reagent or testing paper is a very dilute solution of gold and sodium chloride. Bleached and unbleached sulphite cellulose, sulphate cellulose and soda cellulose produce a reddish-brown color, wood-fibre a yellow color, and bleached straw paper no color.

Danielewsky's test for aromatic substances in blood etc. An azo-reagent (diazo sulphanilic acid ?) is added, the solution slightly acidified with hydrochloric acid and then made alkaline. The presence of aromatic compounds is indicated by the formation of an orange-red color.

David's alcoholic acetic acid for the examination of fatty acids consists of 300 ccm. of 95 p. c. alcohol and 220 ccm. of a mixture of equal volumes of glacial acetic acid and water. This reagent dissolves only the liquid olefinic acids from a mixture of fat acids, whereas the solid fatty acids remain undissolved.

Davy's test for arsenic. See *Marsh's* test.

Davy's test for phenol. Molybdic acid dissolved in concentrated sulphuric acid produces a violet coloration with phenol.

Day's test for mucus. The formation of a blue color upon the addition of 1 to 2 drops of oxidized tincture of guaiac (old, or shaken with air) to urine indicates the presence of mucus.

Deiss' modification of *Labiche's* test for cottonseed oil. See *Labiche.*

Delf's reagent for alkaloids. See *Mayer's* reagent.

Denigés' reagent for the detection of nitrous acid.

1.) a) A solution of phenol 1 g. and 4 ccm. sulphuric acid in 100 ccm. water;
b) A solution of mercuric oxide 3.5 g. in 20 ccm. glacial acetic acid, and 100 ccm. water; ½ ccm. of sulphuric acid is added and filtered.

Equal volumes of a) and b) are mixed, heated to the boiling point and 1 to 2 drops of the solu-

tion to be tested are added. The presence of nitrite causes a red coloration. This reagent is the reverse of *Plugge's* phenol reaction and was first mentioned by this author.

2.) Two ccm. aniline are dissolved in 40 ccm. glacial acetic acid and the solution diluted with water to 100 ccm.

5 ccm. of this solution and a requisite amount of the solution to be tested (1 drop to 10 ccm. according to concentration) are boiled. The presence of a nitrite is indicated by the formation of a straw-yellow to orange color, which becomes red upon the addition of an acid.

3.) A solution of 1 g. resorcin in 100 ccm. water and 10 drops sulphuric acid. Four drops of the solution to be tested, 2 ccm. of pure sulphuric acid and 5 drops of the resorcin are shaken. Nitrous acid produces a carmine or violet coloration.

Denigés' reagent for hydrogen peroxide is a mixture of 1 ccm. of a 10 p. c. aqueous ammonium molybdate solution and 1 ccm. concentrated sulphuric acid. Hydrogen peroxide produces an intensely yellow color with this reagent.

Derbassin's test for nitric acid. See *Roehmont's* test.

Deubner's test for coloring-matter from bile. See *Gmelin's* reaction.

De Vry's herapathite reaction for quinine. To 8 parts of quinoidine sulphate dissolved in 8 parts of 5 p. c. aqueous sulphuric acid an iodine solution (1 p. iodine, 2 p. potassium iodide and 100 p. water) is gradually added. The resinous precipitate, after washing and drying, is dissolved in six times its weight of 92 to 94 p. c. alcohol, the solution filtered and evaporated. The residue is dissolved in five times its weight of alcohol. This solution produces with solution of quinine sulphate a precipitate of iodosulphate of quinine.

De Vry's quinine test (chromate test). To a solution of 1 g. quinine, dissolved in 45 ccm. boiling water, 2.5 g. of neutral potassium chromate are added; the solution is cooled to a temperature of 15°; and after an hour the crystallized quinine chromate is filtered off. To 10 ccm. of the filtrate one drop of soda solution is added or sufficient to effect a reddening of phenolphthalein paper. If the quinine was free from other cinchona alkaloids, the solution remains clear, also upon heating; if other alkaloids were present a turbidity is produced.

Dietrich's reaction for uric acid. Upon the addition of sodium hypochlorite solution contain-

ing bromine to a solution of uric acid an unstable rose-red color is produced.

Di Vetere's test for castor oil in olive oil. Upon shaking a sample of the oil with concentrated hydrochloric acid three layers are formed if castor oil is present.

Dobbin's reagent for caustic alkali is a solution of mercuric iodide, potassium iodide and ammonium chloride. Caustic alkalies, including ammonia, produce a yellowish to reddish-brown color or precipitate. The reagent is prepared by adding a solution of mercuric chloride to a solution of 5 g. potassium iodide until a permanent precipitate is produced. This is removed by filtration. Then 1 g. ammonium chloride is added and sufficient dilute caustic soda solution until again a permanent precipitate is produced. The filtrate is diluted to 1 liter.

This reagent is serviceable for the detection of traces of alkali in potassium and sodium carbonate.

Donath's test for nitrogen. 0.05 g. substance are heated with 1 g. potassium permanganate and 20 ccm. pure, saturated potassa solution to boiling. If necessary more permanganate is added to effect permanent coloration. Upon cooling the mixture is diluted with water, the excess of permanganate destroyed by the addition of alcohol, the precipitate removed by filtration and the filtrate tested for nitric acid according to known methods.

Donné's test for mucus (in urine). To the sediment, obtained by removing the supernatent liquid, a fragment of caustic potassa is added and the mixture is stirred. Mucus is colored greenish and gelatinizes to a lumpy mass; a gelatinous sediment is partly dissolved, partly converted into a flocculent precipitate.

Dragendorff's reagent for alkaloids. (Potassium-bismuth iodide). Bismuth iodide is heated with a solution of potassium iodide, the mixture filtered while hot, and to the hot filtrate an equal volume of cold concentrated solution of potassium iodide is added. The concentrated solution is permanent, the dilute solution not. According to *Frohn* the reagent is prepared by suspending 1.5 g. of freshly precipitated bismuth subnitrate in 20 g. water, heating the mixture to the boiling point and adding 7 g. potassium iodide and 20 drops of hydrochloric acid. The reagent produces a reddish-brown precipitate with alkaloids, but also with albuminous substances.

Comp. *Mangini's* and *Thresh's* reagent.

Dragendorff's test for alcohol in volatile oils. Metallic sodium is added to the oil in question. If alcohol is present hydrogen is generated and a brownish color is produced.

Dragendorff's test for coloring-matter from bile. See *Gmelin's* test.

Drechsel's test for "Gallensäuren." See *Pettenkofer's* reaction.

Drouot's test for margarin in butter. The sample is melted: butter is transparent, margarin turbid. *Bischoff*, also *Jahr* have recently devised apparatus whereby the behavior of the molten fat when shaken with warm water can be observed. Margarin rapidly separates from the water, whereas the butter is completely emulsified. For details see Ph. Centrh., 37, p. 43.

Dudley's reagent for glucose. Bismuth subnitrate is dissolved in a little nitric acid, an equal volume of acetic acid is added to the solution and diluted with water to ten times its volume. The urine to be tested is made alkaline, a few drops of the reagent are added and the mixture boiled for from 20 to 30 seconds. In the presence of glucose the bismuth compound is reduced, a black precipitate being produced.

Comp. *Aimén's*, *Boettger's* tests.

Duflos' aniline reaction. With dilute sulphuric acid and a trace of lead peroxide aniline produces a greenish color.

Dupasqier's reagent for organic substance in water is an aqueous solution of gold chloride. If water is boiled with this reagent the presence of organic matter is indicated by a blueish-violet color due to the reduction of the gold, or by the formation of a gold mirror.

Eboli's reaction for cantharidin. The solution to be tested is heated with sulphuric acid and potassium-bichromate is added. If cantharidin is present a handsome green color is produced.

Ehrlich's diazo-reaction is the test for pathologically changed urine by means of diazo-benzene sulphuric acid. *Pentzoldt* (q. v.) uses the reaction for the detection of glucose (upon the addition of potassa), *Ehrlich* and others for the diagnosis of various diseases (upon addition of ammonia), especially for the detection of bile coloring matter. The directions differ materially. The reagent is always freshly prepared, e. g. according to the following formula:

a.		*b.*	
Sulphanilic acid...	5	Sodium nitrite.....	0.5
Hydrochloric acid	50	Water.....	100
Dist. water.....	1000		

For use, 6 ccm. of solution *b* are added to 250 ccm. of solution *a*.

According to more recent statements a diazobenzene sulphuric acid 1:60 is employed as *Ehrlich's* reagent.

Urine is tested according to different methods:

I. Equal volumes of urine and the reagent are mixed and ¼ volume of ammonia is added. In case of typhus, pneumonia, measles, the solution is colored red, the color being readily recognizable in the foam when the solution is shaken.

II. According to Charité, Annalen, 1886, for the detection of bile coloring matter, *Erlich's* reagent is added to urine diluted with an equal volume of dilute acetic acid. The resulting dark color is converted into violet upon the addition of an acid, particularly of glacial acetic acid.

III. The urine to be tested is shaken with chloroform. To the chloroformic solution 1 to 2 volumes of *Ehrlich's* reagent and sufficient alcohol to make the mixture homogeneous are added. If bilirubin is present a red color is produced, which upon careful addition of concentrated hydrochloric acid is converted into violet and blue. Upon the addition of potassa solution three zones are produced, a lower greenish-blue one, an upper pure blue zone and between a reddish band.

Erlich's gentian violet solution for staining bacteria is produced by shaking 4 ccm. aniline with 100 ccm. distilled water and separating the solution from the undissolved aniline by filtration through a moist filter. To the filtrate 11 ccm. of a concentrated alcoholic solution of gentian violet are added while shaking, and the mixture is allowed to stand for 24 hours.

Einbrodt's reagent for ammonium salts is a solution of mercuric chloride made slightly alkaline by the addition of potassium carbonate. With ammonium salts this solution produces a white turbidity or precipitate.

Einhorn's test for sugar in urine by means of the fermentation method. The formation of carbonic acid upon treating the urine with yeast is construed as a certain indication of the presence of glucose in the urine. *Einhorn* and others (v. *Arndt*) have constructed special fermentation saccharometers, which permit an exact quantitative estimation.

Erdmann's reagent for alkaloids. Six drops nitric acid 1.25 are mixed with 100 ccm. water and of this solution 10 drops are added to 20 ccm. pure concentrated sulphuric acid. According to another statement 10 drops of nitric acid 1.185

are diluted with 20 ccm. water and 20 drops of this solution are added to 40 ccm. pure concentrated sulphuric acid. To 1 to 2 mg. of the dry alkaloid, placed on a watch-glass over white paper or in a white porcelain dish, 1 ccm. of the reagent is added and the mixture is set aside for ¼ to ½ hour at a temperature of from 18 to 22° C. As to the resulting color reaction consult *Hager*, Pharm. Praxis I, 208.

Erlicki's solution, a hardening solution for microscopic preparations, contains 2.5 g. potassium bichromate and 0.5 g. copper sulphate in 100 ccm. water.

Errera's solution for the extraction of alkaloids is an alcoholic 5 p. c. tartaric acid solution.

Erbach's reagent for albumen is a solution of 10 g. picric acid and 20 g. citric acid in 1 l. water. In albuminous solutions (urine) the reagent produces (eventually upon the addition of acetic acid) a yellow precipitate. The amount of the latter, which can be estimated approximately in the albuminometer, can serve also for the quantitative estimation of albumen.

Erbach's ureometer. See *Huefner's* reagent.

Eykmann's phenol reaction. A very dilute phenol solution produces upon the addition of a few drops of spirit of nitrous ether in contact with concentrated sulphuric acid a red zone reaction.

Farrant's solution, a preservative for microscopic preparations, consists of 1 p. gum arabic, 1 p. glycerin and 1 p. concentrated aqueous solution of arsenious acid.

Faure's test for genuine wine coloring matter. If to 2 ccm. red wine 10 drops of a 2 p. c. tannin solution and 6 drops of a 2 p. c. gelatine solution are added, the coloring matter from wine is completely precipitated, whereas coal-tar dye-stuffs remain in solution.

Fehling's solution for the estimation of sugar and reagent for other reducing substances. For immediate use equal volumes of the following solutions are mixed.

I. 34.639 g. crystallized, not effloresced copper sulphate are dissolved in water and the solution diluted to 500 ccm.

II. 173 g. crystallized Rochelle salt and 50 g. caustic soda are dissolved in sufficient water to make 500 ccm.

To the reagent diluted with 5 p. of water the sugar solution of about 1 p. c. strength is gradually added. Discoloration takes place and red cuprous oxide is precipitated. 10 ccm. of *Fehling's* solution are reduced by 0.05 g. grape sugar,

0.067 g. milk sugar, 0.0475 g. cane sugar and 0.045 g. dextrin or starch, the last three having been previously inverted with dilute mineral acid. It should be understood that many other substances also reduce *Fehling's* solution.

According to an older formula *Fehling's* solution was prepared as a single solution and had to be prepared fresh every time since the mixed solutions do not keep well.

Solutions identical with or similar to *Fehling's* reagent are *Barreswil's, Frommherz's, Trommer's, Violette's* and *Worm-Mueller's* solutions (q. v.).

Fiebig's sugar estimation by means of the fermentation glucoseometer. See *Einhorn.*

Finkelnburg's reagent for excrements in the examination of soil and water is an alkaline solution of silver oxide in sodium thiosulphate. If substances containing excrements are boiled with hydrochloric acid for several minutes, then made alkaline with soda and again heated to the boiling-point with the reagent, a dark reddish-brown precipitate is found, whereas the solution remains light brown in color.

Finkener's test for impurities in castor oil. 10 ccm. of oil are shaken with 50 ccm. alcohol, sp. gr. 0.829 at 17.5°. If a turbidity is produced which does not disappear when the mixture is heated to 20° at least 10 p. c. of foreign oils have been added.

Filsinger's test for cacao oil (modified ether test). Two g. of oil are shaken in a graduated tube with 6 ccm. of a mixture of 4 p. ether 0.725 and 1 p. alcohol 0.810 and set aside. Pure oil yields a clear solution which does not become turbid at 0°.

Fischer's reagent is phenylhydrazine. With aldehydes, ketones, carbohydrates it yields condensation products which are difficultly soluble. In order to test for sugar in urine, 50 ccm. of the latter are heated with 2 g. phenylhydrazin hydrochlorate and 4 g. sodium acetate for ½ to 1 hour on the waterbath. If sugar is present, phenylglycosazone is precipitated. This is dissolved in alcohol, water is added and the alcohol is evaporated. The resulting needles of the glycosazone melt at 204 to 205°.

Fleischl's test for bile coloring matter. See *Gmelin's* test.

Fleitmann's arsenic test. See *Marsh's* arsenic test.

Flueckiger's arsenic test. In place of the silver nitrate used according to *Gutzeit* (q. v.) solution of corrosive sublimate is employed. With

it arsenuretted hydrogen produces a yellow spot, which is darkened by water but is permanent toward alcohol. Very dilute antimony hydride does not affect the corrosive sublimate. Somewhat less diluted it produces a brown spot which disappears upon the addition of alcohol if sufficient sublimate was on the test-paper.

Flueckiger's reaction for quinine. If to a solution of quinine bromine water and an excess of ammonia are added, an emerald-green color is produced (Thalleiochin reaction). Compare *Brand's* reaction.

Flueckiger's test to distinguish between naphtholes. If 0.2 g. naphthol are shaken with 0.2 g. mercuric chloride, 0.1 g. nitric acid and 10 ccm. water at 100°, α-naphthol is indicated by a slight scarlet-red precipitate, whereas β-naphthol yields a voluminous reddish-brown precipitate.

Flueckiger-Behren's test for sesame oil. Five drops of sesame oil when treated with 5 drops of a cold mixture of equal parts of concentrated sulphuric acid, nitric acid and water, produce a green zone. If 5 drops of carbon disulphide are immediately added an upper greenish layer is produced, which becomes discolored more slowly than the original color.

Focke's test for grape sugar. See *Trommer's* reaction.

Fokker's reaction for the detection of uric acid. If to urine containing uric acid, previously made alkaline with soda, solution of ammonium chloride is added, the difficultly soluble urate of ammonium is formed. This test is also used, especially according to *Salkowsky's* modification, for the quantitative estimation.

Formanek's reaction for alkaloids. Various alkaloids, after the evaporation of their solutions in nitric acid (see *Vitali*), yield characteristic color reactions when treated with ammonia and the alkalies. For details consult Ph. C. 36, p. 600.

Fraude's reagent for alkaloids is an aqueous solution of perchloric acid, sp. gr. 1.13 to 1.14. Upon boiling a trace of the alkaloid with several cubic centimeters of the reagent, aspidospermine is colored bright red, brucine madeira red, strychnine reddish-yellow.

Fresenius' phenol reaction. If phenol is boiled with a solution of mercurous nitrate containing traces of free acid, metallic mercury is precipitated and the odor of salicylic aldehyde is produced. Comp. *Plugge's* phenol reaction.

Fresenius' detection of nitrous acid by distillation. The water to be examined is acidulated

with acetic acid and distilled. The distillate is collected in potassium iodide starch solution acidulated with sulphuric acid, whereby nitrous acid is indicated by the formation of a blue color.

Frey's fuchsine solution for staining microscopic preparations is a solution of 0.01 g. crystallized fuchsine, 20 to 25 drops absolute alcohol and 15 ccm. water.

Fritsche's reagent is dinitroanthraquinone. With many hydrocarbons it yields crystalline compounds.

Froehde's reagent for alkaloids is a freshly prepared solution of 0.01 g. sodium molybdate in 1 ccm. concentrated sulphuric acid (according to others 0.01 g. : 10 ccm., also 1 g. : 10 ccm.). With alkaloids and glucosides it produces characteristic color-reactions. For details consult *Hager*, Pharm. Praxis I, 208. Proteïnes produce a dark blue color.

Froehde's hydrocyanic acid reaction. If a cyanide is fused with sodium thiosulphate, the fuse dissolved in water and some ferric chloride added a blood-red color results.

Frommherz's solution for the detection of glucose consists of 41.76 g. crystallized copper sulphate, 20.88 g. potassium bitartrate and 10.44 g. potassa dissolved in water sufficient to make a liter. See *Fehling's* solution.

Fuerbringer's reagent for albumen is a mixture of mercuric and sodium chloride with citric acid and sodium chloride. In albuminous urine the reagent produces a turbidity or a flocculent precipitate. Inasmuch as uric acid is likewise precipitated the urine must first be diluted. See *Stuetz's* albumen capsules.

Gabbet's dye for tuberculose bacilli consists of 2 g. methylene blue, 25 g. concentrated sulphuric acid and 75 g. water.

Gaglio's test for mercury vapors in the atmosphere. The air to be tested is passed through a solution of palladium chloride in 500 p. water. (The palladium chloride is previously dissolved in hydrochloric acid with the aid of nitric acid and repeatedly evaporated to dryness with hydrochloric acid.) If mercury is present the solution is reduced as shown by the formation of black spots.

Gallois' test for inosite in urine. After the glucose is removed by fermentation and the albumen by boiling the urine is evaporated to a small bulk and a few drops of mercurous nitrate solution are added. If inosite is present the residue upon complete evaporation is yellow. (Albumen colors the residue rose-red, sugar colors it black; hence these must be removed completely.)

Ganther's blood-reaction. Minute traces of

blood eliberate oxygen from hydrogen peroxide producing foam. Other animal substances produce the same phenomenon.

Gardiner's reagent for tannic acid is a solution of ammonium molybdate, which produces a yellow precipitate with the acid.

Gassend's modification of *Baudouin's* reaction (q. v.) for sesame oil consists in the addition of sodium bisulphite, which removes the color occasionally produced with genuine olive oil, but does not affect that produced by sesame oil. To 15 ccm. oil and 10 ccm. of sugar solution in hydrochloric acid 2 to 3 ccm. of a 10 p. c. bisulphite solution are added, the mixture shaken and set aside for 5 minutes. If the red color remains the oil is supposed to be adulterated with sesame oil.

Gautier's precipitation of tannin is effected by shaking with cuprous carbonate and the addition of alcohol, or by the addition of aqueous copper acetate 1:30.

Gautier's reagent consists of 250 ccm. soda-solution, 50 ccm. 3 p. c. copper sulphate solution and 700 ccm. glacial acetic acid. This mixture precipitates serum-albumen from its solutions, but not egg-albumen.

Geissler's test-paper for albumen consists of strips of filter-paper, half of which are saturated with concentrated citric acid solution, half with 3 p. c. sublimate solution to which 12 to 15 p. c. potassium iodide have been added. First a strip of the acid paper is dipped into the urine to be tested, then the mercury-potassium iodide paper. If albumen is present a precipitate results. Concentrated urine must first be diluted. See *Oliver.*

Geitel's test for neutral fat in free fatty acids. Two gr. of the fatty acids are dissolved in 15 ccm. hot alcohol and 15 ccm. ammonia are added. If a considerable percentage of neutral fat is present the solution becomes turbid. Traces of neutral fat are detected by adding carefully a layer of cold methyl alcohol. If neutral fat is present a turbidity is produced at the zone of contact.

Geogehan's acid reaction. All inorganic as well as organic acids with the exception of hydrocyanic acid precipitate red mercuric iodide from the solution of the double salt of mercuric cyanide and potassium iodide.

Gerard's test for coloring matter from the bile. Solution of iodine in aqueous potassium iodide is added in small quantity to the chloroformic extract of the urine to be tested. If potassa solution is added the reddish color of the chloroformic extract disappears and in the presence of bile coloring matter the potassa solution is colored green.

Gerrard's test for atropine and hyoscyanine is a solution of 5 g. mercuric chloride in 95 g. 50 p. c. alcohol. If 2 ccm. are heated with 0.001 g. atropine a red precipitate is formed. Hyoscyamine produces a similar precipitate. Homatropine is not precipitated.

Giessel's reaction for cocaïne. 5 ccm. of a 1 p. c. solution of cocaïne yield upon the addition of 2 ccm. saturated potassium permanganate solution a violet precipitate of cocaïne permanganate.

Girard's reaction for coaltar dyestuffs in wine. To 20 ccm. of the wine to be tested 4 ccm. of 10 p. c. potassa solution and 20 ccm. of a 5 p. c. mercurous sulphate solution are added, the mixture shaken and filtered. Natural wine yields a colorless, artificially colored wine a red filtrate.

Glaessner's reaction for the distinction between fatty oils depends upon the behavior of these oils toward fuming nitric acid, concentrated sulphuric acid and carbon disulphide. For details consult *Benedikt*, Analyse der Fette, 2, p. 309.

Gmelin's salt is potassium ferricyanide.

Gmelin's reaction for biliary coloring matter. A layer of the urine to be tested is carefully poured over fuming nitric acid. In the presence of biliary coloring matter zone color-reactions are produced changing from green to blue, violet, red and yellow. In order to concentrate the intensity of the reaction a precipitate of barium sulphate is produced in the urine which carries with it the coloring matter. The collected and dried precipitate is then tested with nitric acid.

Modifications after:

Bruecke. Dilute, boiled nitric acid is first added, then concentrated sulphuric acid.

Vitali. A few drops of potassium nitrite solution are added, then dilute sulphuric acid.

Masset. Concentrated sulphuric acid is first added to the urine, then a crystal of potassium nitrate; green streaks emanate from the fragments of the nitrite.

Fleischl. The urine is mixed with an equal volume of a concentrated solution of sodium nitrite, then a layer of concentrated sulphuric acid is added from below by means of a pipette.

Rosenbach. Nitric acid containing nitrous acid is added to the filtered urine.

Dragendorff, Deubner, filter through porous plate in place of ordinary filter-paper and then make the nitric acid test on the plate.

Hilger. The urine is treated with barium hydrate at a moderate temperature and the resulting precipitate, after being washed, is tested with nitric acid.

Godeffroy's reagent for alkaloids is a solution of antimony chloride. From aqueous hydrochloric acid solutions it precipitates aconitine, atropine, quinine, cinchonine, piperine, strychnine, veratrine in form of white or yellow precipitates. Caffeine and morphine are not precipitated.

Godeffroy and **Laubenheimer's** reagent for alkaloids is silico-tungstic acid, which produces sparingly soluble precipitates with the hydrochloric acid solutions of the alkaloids.

Gouver's solution for the detection of albumen is a solution of mercuric cyanide in an excess of potassium iodide. With albuminoids this solution produces a white precipitate.

Godbay's (also *Goadby's*) solution serves for the preservation of microscopic sections and consists of 120 g. sodium chloride, 60 g. alum, 0.25 sublimate and 2.33 liters of water.

Grahe's test for genuine cinchona barks. Genuine cinchona barks when heated in a test tube yield red fumes, whereas spurious barks produce vapors and tar of a brownish color.

Gram's dye for bacteria is prepared by shaking 15 drops of aniline with 15 g. water, filtering the solution and adding to the filtrate 4 to 5 drops of saturated alcoholic solution of gentian violet.

After the preparations are stained with the above dye they are brought into a solution of iodine in potassium iodide (1 g. iodine, 2 g. potassium iodide, 300 ccm. water) and then into alcohol. Certain bacteria (anthrax) retain the color, whereas others (cholera, typhus, Bact. Coli) are discolored.

Grandeau's reaction for alkaloids. To the solution of the alkaloids in concentrated sulphuric acid bromine water is carefully added. With some alkaloids it produces characteristic color reactions. Thus e. g. the solution of digitaline and digitaleïne in sulphuric acid is yellow, but becomes rose-red to violet through the action of bromine. Preparations of digitalis produce the same reaction. Morphine also produces a red color.

In place of bromine water *Dragendorff* employs a solution of bromine in potassium hydroxide or bromine vapors.

Greittherr's cocaïne reaction. If to a few drops of a cocaïne solution mixed with 2 to 3 ccm. chlorine water a few drops of 5 p. c. palladium chloride solution are added, a handsome red precipitate is produced, which is insoluble in alcohol and ether, but soluble in sodium hyposulphite solution.

Greshoff's reaction for iodoform. With silver nitrate, iodoform reacts readily with formation of carbon monoxide, silver iodide and nitric acid.

Griess' reaction for nitrous acid.

I. A solution of a salt of m-phenylenediamine produces a yellowish-brown color with nitrous acid. A 0.5 p. c. solution of the base is prepared with the aid of sulphuric acid, sufficient to produce an acid reaction. If the solution is not colorless, it should be decolorized with freshly burnt animal charcoal.

II. A solution of sulphanilic acid and naphthylamine sulphate is colored red by traces of nitrous acid. The solution to be tested is acidified with sulphuric acid, sulphanilic acid solution is added and after a few minutes, solution of naphthylamine sulphate which has been decolorized with animal charcoal. S. *Lunge*.

Griess' reaction for fæcal matter in water is a 1 p. c. solution of diazosulphanilic acid, which has been made alkaline with soda solution. Water containing fæcal matter becomes yellow within five minutes upon addition of this solution.

Griess' test paper is paper saturated with one of *Griess'* reagents for nitrous acid. (q. v.)

Griess-Ilosway's reagent for nitrous acid is an acetic acid solution of sulphanilic acid and naphthylamine.

Guezda's reagent for albumens consists of nickel sulphate and ammonia.

Guenzburg's reaction for free hydrochloric acid in gastric juice. 2 g. phloroglucose and 1 g. vanillin are dissolved in 30 g. alcohol. If a few drops of this solution are evaporated with an equal amount of gastric juice in a porcelain capsule, the presence of hydrochloric acid is indicated by the formation of a red film.

Guignet's reagent is an ammoniacal solution of copper sulphate.

Gunning's test for acetone. If to the solution to be tested (e. g. distillate from urine) tincture of iodine and ammonia are added, iodoform and a black precipitate of nitrogen iodide are formed. The latter gradually disappears and the yellow color of the iodoform predominates. Alcohol in this case does not produce iodoform. (Comp. *Lieben's* reaction).

Guyon's reagent for the detection of aldehydes is obtained if to a solution of 1 g. fuchsine in 1 liter water a mixture of 20 ccm. sodium acid sulphite solution of 30° Bé and 10 ccm. concentrated hydrochloric acid is added.

If 1 ccm. of this reagent is brought in contact with 2 ccm. of the solution to be tested, the

presence of aldehyde is indicated by the formation of an intensely purple-red reaction.

This reagent is also known as *Schiff's* reagent.

Gutzeit's test for arsenic. The substance to be tested is transferred to a test tube containing pure zinc and pure dilute sulphuric acid. The mouth of the tube is closed with a piece of filter-paper moistened with a few drops of silver nitrate solution 1:1. The arsenuretted hydrogen formed if arsenic is present produces a yellow spot on the paper, which is blackened upon the addition of water. (See *Flueckiger's* test for arsenic.)

Frohn's reagent for albuminous substances and alkaloids is prepared by boiling 1.5 g. freshly precipitated bismuth subnitrate with a solution of 7 g. potassium iodide in 20 ccm. water and then adding 20 drops of hydrochloric acid. The orange-yellow solution produces precipitates in the acid solutions of albumen and alkaloids.

Hager's reagent for alkaloids is a solution of picric acid, which produces precipitates in alkaloidal solutions. The same solution can also be used as a reagent for albumen by pouring a layer of the reagent over one of the solution (urine) to be tested. In the presence of albumen a turbidity is produced.

Hager's reaction for colchicine. In concentrated solutions of colchicine, a solution of borax produces a white precipitate. In dilute solution the precipitate is not formed at ordinary temperature, but upon heating to 50°.

Hager's test for alcohol in volatile oils. If a grain of tannin is added to the oil it deliquesces to a sticky mass if alcohol is present. If a drop of the oil is poured into water, the presence of alcohol is indicated by the formation of a milky turbidity.

Hager's test for the purity of alcohol (aniline test). 1 g. cacao oil is dissolved in 2 to 3 g. aniline contained in a test tube and set aside for 1½ hours at a temperature of 15° C. If the oil is pure it floats as a clear liquid layer on the aniline. If tallow, wax, stearin or paraffin are present the oily layer shows granular formations or has solidified entirely.

Hager's test for the hydrides of sulphur, arsenic, antimony and phosphorus. The hydrides formed by the action of zinc and sulphuric acid upon the substance to be tested are allowed to act on parchment paper moistened with solution of silver nitrate. If the resulting brown or black spot is macerated with 10 p. c. solution of potassium cyanide, the color resulting from the action of sulphuretted hydrogen disappears at

once, that resulting from the hydrides of antimony and phosphorus disappears gradually (1—2 hrs.), that from the arsenuretted hydrogen not at all.

Hager's arsenic test (Kramato method). A hydrochloric acid solution of arsenic or arsenous acids, when heated gently with a strip of copper, produces a permanganate-like spot. Commercial tin or tin-foil can also be used. Comp. *Reich's* test for arsenic.

Hager's test for cholesterin. See *Salkowski*.

Hager's glycerin reaction. If an aqueous solution of glycerin colored blue by litmus tincture is mixed with a solution of borax likewise colored blue by means of litmus, the mixture assumes a red color. Comp. *Linde's* test for glycerin.

Hager's butter test. (Organoleptic reaction.) A cotton wick is saturated with the liquified fat and ignited. After 2 minutes the flame is extinguished. Pure butter develops the odor of strongly fried butter, margarin that of acroleïn.

Hager's test for glucose is a solution of 30 g. red mercuric oxide, 30 g. sodium acetate, 50 g. sodium chloride, 25 g. glacial acetic acid and 400 ccm. water diluted to a liter. If a solution containing glucose (diabetic urine) is heated with the reagent, a precipitate of mercurous chloride results.

Hager's test for potable water consists in the addition of a tannin solution (1 tannin, 4 water, 1 alcohol). Potable water should not produce a turbidity upon standing even for some time.

Hager has devised numerous other reactions which are occasionally referred to by his name. Those not mentioned here can be found in the well-known hand-books of the author.

Haine's solution for the detection of glucose is a solution of 3 g. copper sulphate, 9 g. potassa, 100 g. glycerin in 600 g. water. Glucose (diabetic urine) effects upon the application of heat the precipitation of red cuprous oxide.

Hammersten's reaction for indican in urine. The urine is mixed with an equal volume of fuming hydrochloric acid, solution of chlorinated lime is added drop by drop, and the mixture shaken out with chloroform. The latter takes up the indigo resulting from the indican and is colored blue. An excess of chlorinated lime is to be avoided. This is also known as *Joffe's* test.

Hannstein's aniline mixture for staining microscopic preparations is a mixture of equal parts of methyl violet or fuchsine, or of 1 p. violet and 2 p. fuchsine. For use, a concentrated alcoholic solution of the mixture is prepared.

Hauchecorne's reaction for cotton-seed oil in olive oil. 6 g. oil are heated with 2 g. pure

nitric acid ($3HNO_3$ 40° Bé + $1H_2O$) on a water-bath for 20 minutes. Pure oil remains unchanged or becomes lighter. Adulterated oil assumes an orange-brown-red. Pure oil should solidify within 24 hours to a flesh-colored mass. The nitric acid must be free from nitrous acid.

Hefelmann and **Mann's** test for fluorine in beer depends upon the precipitation of fluorides as calcium or barium fluoride. Upon treating the precipitate containing fluorides with sulphuric acid, hydrofluoric acid is formed which is recognized by its glass-etching properties.

Hegler's test for lignin. The sections are covered with alcohol and treated with a dilute alcoholic solution of thallium sulphate. Lignin is colored orange-yellow, whereas cellulose and cork remain colorless.

Hehn's chloral reagent for volatile oils and resins. 100 ccm. of alcohol are saturated with chlorine and the resulting hydrochloric acid partly removed by distillation. Then sulphuric acid is added and the resulting metachloral is distilled. Two drops of the latter when brought together with a drop of certain volatile oils or a fragment of some resins produces characteristic color reactions. (*Dragendorff*, Analysis of Plants.) Oil of myrrh, or the petroleum ether extract of myrrh produces a violet color with the reagent.

Hehner's figure denotes the amount of insoluble fatty acid yielded by 100 g. of fat, and serves for the characterization of fats.

Heinrich's solution for the determination of glucose. See *Sachsse's* solution.

Heller's test for coloring matter from blood. Urine rendered strongly alkaline with caustic potash solution yields upon boiling in the presence of the coloring matter of the blood, a reddish precipitate of the alkaline earth phosphates.

Heller's test for albumen in urine. Urine containing albumen, when poured upon heated nitric acid so as to form two layers, will show a white ring at the zone of contact.

Heller-Teichmann's test for blood. Urine containing blood, when heated to the boiling-point with a drop of acetic acid, forms a brownish-red to blackish coagulate. If to this boiling hot liquid a little caustic soda solution is added, it becomes clear and forms a sediment of earthy phosphates which by the adhering coloring matter of the blood appears red to brownish-red in diffused, greenish in direct sunlight.

Heller's test for glucose. Glucose solutions or urine containing glucose are colored yellow to

reddish-brown upon heating with caustic potash. Compare *Moore's* test.

Herbst's aconitine reaction. Upon carefully concentrating a solution of aconitine in phosphoric acid, a dirty violet color is produced in the presence of aconine. Pure, crystallized aconitine does not give this reaction.

Hesse's quinine test for the presence of allied alkaloids. These are less soluble in ether, while their sulphates are more readily soluble in water than the corresponding quinine salt. Shake 0.5 g. of quinine sulphate with 10 ccs. of water of 50°—60° C.; after standing 15 minutes, filter off 5 ccs., add 1 cc. ether (sp. gr. 0.7203) and 5 drops of ammonia water (sp. gr. 0.96). The presence of quinidine, conchonine etc. is indicated by the immediate or gradual formation of crystals in the ethereal layer.

Herapath's quinine reaction. Alcoholic solutions of quinine yield upon the addition of tincture of iodine, crystalline precipitates of quinine iodosulphate. This separates in thin plates, of a green color at ordinary temperatures, brownish-red at 100° C. and possessing strong optical properties. For the microscopical examination of the urine, this, after being rendered alkaline, is shaken with ether, the ether evaporated and a portion of the residue dissolved on the cover glass in a drop of a mixture of 11.25 g. acetic acid, 3.75 g. alcohol, and 6 drops of dilute sulphuric acid. To this is added a small drop of tincture of iodine.

Heydenreich's test for foreign oils (cottonseed oil) in olive oil. Allow a few drops of the oil to be tested to fall upon some pure sulphuric acid which covers a surface, about the size of a dollar, in a porcelain capsule. In the case of pure oil, the zone of contact is yellowish-green; with oils derived from seeds, it is yellowish-orange to brown.

Heynsius' test for albumen in urine. Boil 5—10 ccs. of the filtered urine with a few drops of dilute acetic acid and then add a saturated solution of common salt. A white precipitate results in the presence of albumen.

Hilger's test for coloring matter from the bile. The coloring matter is precipitated by boiling with barium hydroxide. The yellow precipitate, filtered and washed, gives the following reactions: Upon treating with alcohol and a few drops of sulphuric acid, the precipitate is rendered colorless while the solutions becomes green. If the precipitate is treated with nitric acid containing nitrous acid, green and blue colors result. (See *Gmelin.*)

Himmelmann's arsenic test. See *Marsh's* test.

Hirschsohn's test for acetanilid in phenacetin. 0.1 g. phenacetin are dissolved in 10 ccs. water, the solution filtered after cooling, and treated with bromine water until a yellow coloration results. If the solution becomes turbid, acetanilid was present (formation of p.-bromacetanilid).

Hirschsohn's test for chloral alcoholate in chloral hydrate. 1.0 g. chloral hydrate is tested with 1 cc. nitric acid (sp. gr. 1.38). If at the room temperature or upon warming a yellow color results within 10 minutes, alcoholate was present.

Hirschsohn's test for pine resin in guaiac resin and balsam of tolu. A very finely powdered sample is shaken for 10–15 minutes with 4–5 times its weight of petroleum ether. In the presence of pine resin, an aqueous solution of copper acetate produces a green color in the filtrate.

Hirschsohn's test for fatty oils in balsam of copaiba. 20—40 drops of the balsam are boiled with 1—2 ccs. of a solution of 1 p. NaOH in 5 p. of 95 p. c. alcohol. The presence of oils is indicated by a jelly-like mass separating or a turbidity being produced, upon cooling or by the addition of 2 volumes of ether. Pure copaiba balsam with 3 vol. of 90 p. c. alcohol should yield a mixture from which no oil globules should separate within an hour.

Hirschsohn's test for gurjun balsam in copaiba balsam. 1 vol. of balsam, 3 vol. 95 p. c. alcohol and 1 g. crystallized stannous chloride are boiled together until complete solution results. Admixtures of gurjun balsam are shown by the appearance of a red coloration, changing to blue upon standing.

Hirschsohn's test for gurjun balsam. 2 ccs. of a solution of conc. sulphuric acid in acetic ether (1–5), when added to 3–4 drops of gurjun balsam, causes a violet coloration. For testing copaiba balsam, add 6—8 drops of the balsam to a solution of 2 drops sulphuric acid in 4 ccs. acetic ether. A violet color indicates the presence of gurjun balsam.

Histed's reaction for nataloin. If nataloin is dissolved in conc. sulphuric acid and a small crystal of potassium nitrate be added, a green color is produced, gradually changing to red and then to blue.

Hlasiwetz's hydrocyanic acid reaction. If an alkaline cyanide solution is warmed with picric acid, a blood-red color results.

Hoffmann's reagent for albumens and phenols is a solution of mercuric nitrate containing a trace of free nitrous acid. Yields similar color reactions

as *Millon's* reagent. See *Hoffmann's* reaction for tyrosin.

Hoffmann's reaction for chloroform. If traces of ammonium chloride and ferrous chloride are warmed with a saturated solution of alcoholic potash and a few drops of chloroform, then the mixture diluted with water and rendered acid with hydrocyanic acid, a greenish-blue coloration results.

Hoffmann's reaction for phenol. Phenol with concentrated sulphuric acid and potassium nitrate gives a violet coloration.

Hoffmann's reaction for tyrosin. The hot aqueous solution of tyrosin (obtained from the sediment of urine) produces a red colored precipitate upon the addition of a solution of mercuric nitrate with some potassium nitrate.

Hoffmann's test for primary amines. Upon evaporating an ethereal solution of a primary amine base with carbon bisulphide, dissolving the residue in water, and boiling this solution with silver nitrate, mercuric chloride, or ferric chloride, an odor of mustard oil appears.

Hoffmeister's mixture for the solution of cellulose consists of hydrochloric acid with potassium chlorate.

Hofmann's aniline reaction. With fuming nitric acid, aniline gives a deep blue solution, becoming yellow upon warming and finally turning red.

Hofmann's isonitrile reaction for primary amines. These yield upon warming with chloroform and alcoholic potash the characteristic odor of isonitrile.

Hoehnel's reagent for lignin is phenol-hydrochloric acid (a highly concentrated solution of phenol in fuming hydrochloric acid). Lignin is colored green by this reagent.

Holde's test for unsaponifiable substances in fats. Boil a piece of caustic potash the size of a pea in 5 ccs. of absolute alcohol until completely dissolved, add 3—4 drops of the fat to be tested and boil for one minute. Upon diluting with 3—4 ccs. of water, a turbidity indicates the presence of an unsaponifiable substance.

Holde's reagent for tarry constituents of lubricants obtained from petroleum. Dissolve in petroleum ether in which the tarry admixtures are insoluble.

Hoppe-Seyler's test for biliary coloring matter. The urine is precipitated with milk of lime, the excess of lime precipitated with CO_2, the precipitate filtered and washed with water. If

nitric acid containing nitrous acid is dropped upon the precipitate on the filter, the well-known color reactions are produced if coloring matter from the bile is present. See *Gmelin*.

Hoppe-Seyler's test for sugar in the urine depends upon the formation of indigo when urine containing grape-sugar is heated with o-nitrophenylpropiolic acid. The reagent employed is a ½ p. c. sol. of this acid in soda lye. 5 ccs. of this solution are boiled with a few drops of urine; in the presence of sugar an indigo color is produced.

Hoppe-Seyler's phenol reaction. A spruce shaving is colored blue when moistend with phenol and hydrochloric acid.

Frommasi's modification: Instead of hydrochloric acid, a mixture of 50 ccs. hydrochloric acid, 50 ccs. water, and 0.2 g. potassium chlorate is employed in the above.

Hoppe-Seyler's test for carbon monoxide poisoning. A few drops of the blood to be tested are mixed in a porcelain capsule with an equal or double quantity of caustic soda solution. In case of poisoning by carbon monoxide, the blood will appear of a vermillion color in thin layers, while normal blood will look a dirty brownish-green.

Horsley's test for glucose. Glucose solutions, or urine containing the same, are colored green upon being boiled with caustic potash and potassium bichromate.

Horsley's test for nitric acid. Pyrogallic acid and sulphuric acid yield a violet color with aqueous solutions containing traces of a nitrate.

Houzeau's ozone-paper is red litmus paper, one half of which has been dipped into a solution of potassium iodide. Since ozone liberates free alkali from potassium iodide, the paper will turn blue in the presence of this gas.

Howie's test for curcuma. 0.3 g. of the powdered rhubarb or insect-powder to be tested are heaped upon filter paper in the form of a cone, 50 drops of chloroform are gradually dropped upon this heap, and after drying and removal of the powder, a small piece of borax is placed upon the spot and a drop of hydrochloric acid added. The appearance of the well known red coloration indicates curcuma. *Maisch's* test resembles this one.

Huber's reagent for free mineral acids is an aqueous solution of 5 percent each ammonium molybdate and potassium ferrocyanide. Mineral acids cause in this solution a red turbidity or a brown precipitate, depending upon the quantity present. Boric and arsenious acids do not give this reaction.

Huebl's iodine number serves for the estimation of unsaturated compounds in a substance (oils, resin and the like), and depends upon the power of these compounds of adding iodine. The iodine number of a substance in the quantity of iodine which 100 parts of the substance will take up.

Huefner's reagent for urea is a freshly prepared solution of sodium hypobromite, made by adding 25 g. of bromine at once to a well-cooled solution of 100 g. of sodium hydroxide in 250 g. of water. This solution decomposes urea into CO_2 and nitrogen, the former being absorbed while the latter is measured in a suitable apparatus (*Knop's* azotometer, *Esbach's* ureometer) and the amount of urea thus quantitatively estimated.

Huehnefeld's turpentine solution for testing for blood. Ten volumes each of oil of turpentine, alcohol, and chloroform, are mixed with one volume of glacial acetic acid, and then water added drop by drop as long as the liquid remains clear. The liquid (urine) to be tested for blood is mixed with a few drops of the turpentine solution and a few drops of tincture of guaiac added. A dark blue coloration of the milky mixture indicates blood.

According to *Schär* the test is applied by adding to the suspected liquid a 1 percent solution of guaiac resin in absolute alcohol, and shaking the resulting precipitate, after filtration, with the above mentioned turpentine solution.

Hume's reagent for arsenious acid is a solution of silver nitrate to which is added ammonia water until the precipitate first formed is just redissolved. Arsenious acid with this solution produces a yellow precipitate.

Huppert's test for coloring matter from the bile. The urine is treated with milk of lime or with calcium chloride and ammonia, whereby in the presence of biliary coloring matter, a yellow precipitate of bilirubin-lime is formed. By means of hot alcohol containing sulphuric acid, this is dissolved to a green solution. After the administration of senna or rhubarb, the precipitate with lime is of a rose-red color; the subsequent solution is orange-yellow.

Husemann's morphine reaction. Morphine is heated with concentrated sulphuric acid and after cooling a drop of nitric acid is added. A beautiful dark violet color results, changing to a blood red and gradually fading.

Jacobsen's test for fatty oils. The fatty oil is brought in contact with rosaniline acetate, which is insoluble in neutral fats but is dissolved by free fatty acids.

Jack's test for sugar in the urine consists in identifying the sugar by means of phenylhydrazine, with which it forms a difficultly soluble osazone.

Jacquemart's reaction for distinguishing ethyl from methyl alcohol. Upon heating ethyl alcohol with a solution of mercuric nitrate, the mercuric salt is reduced and a black precipitate results upon the addition of ammonia. Methyl alcohol does not give this reaction.

Jacquemin's aniline reaction. Upon treating a dilute aqueous solution of aniline with a solution of chlorinated lime and then adding a very dilute solution of ammonium sulphide, a rose-red color appears, even in dilutions of 1:250,000.

Jacquemin's phenol reaction. To the liquid to be tested add some aniline, and then a few drops of a solution of sodium hypochlorite. In the presence of phenol a blue color results, which changes to a red upon the addition of acids.

Jahr's test for determining the melting point of butter. See *Dronot's* test.

Jaffé's test for creatinine. In the presence of creatinine, urine gives with an aqueous solution of picric acid and a few drops of soda lye a red coloration, becoming yellow upon the addition of acids. See also *Weyl's* test.

Johnson's reaction for sugar in urine. Upon heating diabetic urine with picric acid and potassium hydroxide solution, a deep red color appears. To remove other reducing substances, *Johnson* recommends the separation of uric acid and creatinine by means of mercuric chloride; after standing for some time and filtering, the excess of corrosive sublimate is precipitated with ammonia, and the solutions now tested as above mentioned.

Jolles' reagent for acetone depends upon the precipitation of the acetone with phenylhydrazine.

Jolles' reagent for albumen in the urine consists of corrosive sublimate 1.0 g., succinic acid 2.0 g., sodium chloride 1.0 g., water 50.0 g. To apply the test, 4—5 ccs. of the filtered urine is poured into each of two test tubes, 1 cc. acetic acid added to each, and then the mixture shaken up, in one case with 4 ccs. of the reagent, in the other with 4 ccs. of water. By comparison of the two samples, traces of albumen (1:120,000) can be identified. Compare *Spiegler's* reagent.

Jolles' test for coloring matter from the bile. The urine to be tested (50 ccs.) is shaken for several minutes in a glass cylinder with a few drops 10 p. c. hydrochloric acid, 5 ccs. of pure chloroform and a saturated solution of barium chloride. After standing for 10 minutes, the chloroform together with the precipitate is removed by means

of a pipette, and the chloroform evaporated off in a test tube on a water-bath. After standing at the room temperature for some time, the watery portion of the residue is decanted from the lumpy precipitate. This latter is distinctly colored even when only 1 p. c. of gall is present in the urine; upon the addition of 3 drops of concentrated nitric acid to which ¼ vol. of fuming nitric has been added, the characteristic green and blue rings are formed.

Jolles' test for iodine in urine. The urine is tested with an equal volume of hydrochloric acid and a few drops of chlorine water added. In the presence of iodine a brown ring results, which colors starch solution blue.

Jolles' test for mercury in the urine. 100 ccs. of urine are warmed with 2 g. of granulated gold, with the addition of some stannous chloride. After decanting the liquid, any amalgam that may be formed is washed with water and then introduced into a test tube with a little water and an equal volume of freshly prepared stannous chloride solution. The slightest traces of mercury cause a distinct turbidity. The mercury can be quantitatively estimated by heating the dried amalgam. Compare *Merget's* test.

Jorissen's reagent for alkaloids is a solution of 1 g. zinc chloride in 30 g. each of hydrochloric acid and water. When evaporated to dryness with this solution, alkaloids give characteristic color-reactions. For particulars see *Hager*, Pharm. Praxis III, 1250.

Jorissen's fusel oil reaction. Upon shaking whisky with ether, evaporating the ethereal layer, and treating the residue with colorless aniline and hydrochloric acid, a beautiful red color is produced if fusel oil was present. The reaction is not produced by fusel oil contained in the alcohol, but is due to the presence of furfurol, another of the fermentation by-products (*Förster*). If considerable quantities of furfurol are present, the liquid may be tested directly with a few drops of aniline and hydrochloric acid.

Jorissen's morphine reaction. Morphine is heated on a water-bath with a few drops of concentrated sulphuric acid and a crystal of ferrous sulphate, and the resulting liquid poured into a few ccs. of ammonia water. At the zone of contact a red color develops, rapidly changing into violet, while the ammonia solution turns blue.

Ittner's hydrocyanic acid reaction. An alkaline cyanide solution when mixed with a solution of a ferrous-ferric salt, yields a precipitate of Prussian blue.

Jungmann's reaction for alkaloids. Upon treating the precipitates obtained with phosphomolybdic acid (comp. *Sonnenschein's* reagent) with ammonia, some are colored blue or green. (*Hager*, Pharm. Praxis I, 203.)

Karle's reaction (see *Wiederholt*).

Kassner's reaction for hydrogen peroxide. Upon the addition of potassium ferricyanide and caustic potash solutions, oxygen is evolved.

Kayser's saccharin test. The substance to be tested is shaken with a mixture of ether and petroleum ether, and the residue left upon evaporation of the ethereal layer tested for sweetness.

Keller's test for the principles of digitalis. The substance to be tested is dissolved in 3—4 ccs. of glacial acetic acid, a drop of dilute ferric chloride solution is added, and the solution poured in a layer upon concentrated sulphuric acid:

Digitonin yields a rose-red zone, which rapidly fades.

Digitalin yields a permanent, carmine-red zone.

Digitalein yields a red zone, fading somewhat rapidly.

Digitoxin yields at first a dirty brownish-green zone, after which the upper portion of the sulphuric acid is colored brownish-red, above which a blueish-green band is formed.

Kerner's test for quinine in urine depends upon the fluorescence of quinine solutions. Since the fluorescence is prevented by sodium chloride, a concentrated solution of mercurous chloride is added to the urine as long as a precipitate is produced. Upon filtration, the presence of appreciable quantities of quinine becomes apparent, more easily by the use of a fluoroscope.

Kerner's test for the purity of quinine salts. Quinine sulphate is much less soluble in water than are the sulphates of the allied alkaloids. If therefore quinine sulphate (or any other quinine salt after the addition of sodium sulphate) is shaken with a definite amount of water, the quantity of ammonia required to produce a permanent precipitate in the filtrate will be a measure of the percentage of allied alkaloids present. Upon digesting 2 g. of pure quinine sulphate in 20 ccs. water at 60°—65° C. for half an hour, then allowing this mixture to stand for 2 hours at 15° C. with occasional shaking, and subsequently filtering through glass wool, 5 ccs. of the filtrate require 4—4.3 ccs. of a 10 p. c. sol. of ammonia. In the presence of cinchonine, quinidine etc., more ammonia will be necessary.

Kieffer's reaction for morphine. Upon the addition of 5—6 drops of ferric chloride solution

(1:8) and 3 drops of a sol. of potassium ferricyanide (1:100), a drop of morphine solution will cause a blue coloration or a blue precipitate in consequence of the reduction of the ferricyanide.

Kieffer's reagent for free mineral acids. A solution of copper sulphate is carefully treated with ammonia water until the resulting precipitate is just redissolved. Solutions of neutral metallic salts which show an acid reaction toward litmus, produce a turbidity with this reagent; if, however, the salts contain free mineral acids, the mixture remains clear.

Kintschgen-Gintl's reagent. See *Millon's* reagent.

Klein's solution for the mechanical separation of the constituents of a powdered mineral, is an aqueous solution of cadmium boro-tungstate, sp. gr. 3.3. See *Thoulet's* solution.

Klunge's reaction for aloes (Cupraloin reaction). A very dilute solution of aloes is colored yellow by the addition of copper sulphate. If sodium chloride is added and the mixture gently warmed, a red color results. Upon adding alcohol in addition to sodium chloride, this color is produced at ordinary temperatures.

Knapp's solution for the determination of glucose is a solution of 10 g. mercuric cyanide and 100 ccs. soda lye (sp. gr. 1.45) in enough water to make a liter. This solution is reduced upon warming with glucose, metallic mercury separating out. Kreatin and kreatinin act similarly. 40 ccs. of the solution correspond to 0.1 g. glucose.

Knop's reagent for the estimation of nitrogen in ammonium salts and in amides by means of the azotometer is sodium hypobromite. See *Hüfner.*

Koch's methyl-violet solution for staining bacteria is made by adding a few drops of a concentrated solution of methyl-violet in absolute alcohol, to 20 ccs. distilled water, whereby an intensely yellow colored solution results.

Koch's tuberculosis stain. 2 ccs. anilin are shaken with 20 ccs. water and the mixture filtered through a wetted filter. To the clear filtrate, alcoholic fuchsin (or gentian-violet) solution is added until a film of metallic lustre indicates saturation.

Koch's cholera reaction. The addition of sulphuric acid to cholera cultures (on peptone) causes a red coloration, due to the action of the sulphuric acid on the two decomposition products of the cholera bacillus: indol and nitrous acid.

Kochler's alkaloid reaction. See *Langley's* reaction.

Koettsdorfer's number indicates the amount of caustic potash, in milligrams, required to completely saponify one gram of a fat.

Kolter's reaction for hypochlorous acid. Shake the liquid to be tested with metallic mercury, whereby, in the presence of this acid, brown oxychloride of mercury is produced.

Kraemer's test for acetone. See *Messinger's* test.

Krehbiel's reaction for coloring matter of the bile. Treat the urine to be tested with one fourth its volume of hydrochloric acid and add chlorinated lime solution drop by drop. In the presence of biliary coloring mater a green color is produced. Bromine water gives the same reaction, called also the *Trousseau-Dumonpallier's* reaction.

Krueger's glucose reagent. See *Boettger's* test.

Labich's reaction for cottonseed oil. Mix 25 ccs. of the melted suspected fat with 25 ccs. of a solution of 500 g. lead acetate in 1 liter water, previously warmed to 35° C., and with 5 ccs. ammonia water (22° Baumé), and stir this mixture for several minutes until a homogeneous emulsion results. In the presence of cottonseed oil, the emulsion is colored orange-red. *Deiss* modified this test to prove the presence of cottonseed oil in olive oil, by dissolving 10 ccs. of the oil in 100 ccs. of ether, shaking the solution with 5 ccs. of a concentrated lead acetate solution and again shaking after the addition of 5 ccs. ammonia water.

Ladendorf's reaction for blood. Treat the solution to be tested with tincture of guaiac wood and then with oil of eucalyptus. In the presence of blood the lower layer is colored blue, the upper one of oil of eucalyptus, violet.

Lafon's reaction for digitalin. This substance yields a blueish-green coloration with a solution of 1 g. of sodium selenate in 20 g. concentrated sulphuric acid. (*Lafon's* reagent.) In place of sodium selenate, the corresponding tellurate may also be employed.

Lamal's morphine reaction. 2—10 drops of morphine solution are evaporated on the water-bath with a like quantity of uranium acetate solution (0.015 g. uranium acetate and 0.01 g. sodium acetate in 5 ccs. water). Permanent light red or hyacinth-red rings remain behind. Oxymorphine gives the same reaction, but toxine and most alkaloids do not.

Landolt's phenol reaction. Upon adding supersaturated bromine water to a solution of phenol, a white, crystalline precipitate of tribrom-

phenol is formed. Similar precipitates result with cresol, oxybenzoic acids, indol, indican, cyanures and other compounds, a fact that must be borne in mind in the examination of urine for phenol.

Langley's reaction for alkaloids. Upon mixing with nitric-sulphuric acid and subsequently supersaturating with soda lye, various alkaloidal salts show characteristic colorations. For details see *Dragendorff*, Ermittelung der Gifte, p. 283.

Langley-Kochler's alkaloid reaction is a modification of the preceeding, whereby the alkaloids are mixed with 3—5 times their weight of potassium nitrate, then 1—2 drops of sulphuric acid are added, followed at once by an excess of concentrated soda solution.

Lassaigne's hydrocyanic acid reaction. Upon adding to a solution containing hydrocyanic acid a few drops of caustic potash solution followed at once by a few drops of copper sulphate solution and slightly acidulating with hydrochloric acid, a white precipitate of cuprous cyanide is formed. A solution of copper sulphate in sulphurous acid can also be employed as a reagent to produce the same precipitate in solutions containing hydrocyanic acid.

Lassaigne's test for organic nitrogenous compounds. Heat about 0.01 g. of the substance to be tested with a small piece of sodium in a test tube, add 2—3 ccs. of water, then some ferrous-ferric salt solution, and acidulate with hydrochloric acid. If any nitrogenous body was present, a precipitate of Prussian blue is formed.

Laubenheimer's reaction for thiotolene. This substance yields a blueish-green color with a solution of anthraquinone in glacial acetic acid. The coloring matter is precipitated by water, but is redissolved by ether to form a violet solution.

Lechini's test for the presence of blood in urea. 10 ccs. of urine are treated with a drop of glacial acetic acid and shaken with 3 ccs. of chloroform. In the presence of coloring matter from the blood, the chloroform will form a red layer at the bottom.

Legal's test for acetone (in the urine). Several ccs. of the distillate from urine are treated with a few drops of a freshly prepared solution of sodium nitroferricyanide and a few drops of soda (or potassa) lye. A red color is produced; after this has faded, an excess of acetic acid is added. In the presence of acetone, a purple color is produced. Creatinine also shows a fading of the first-formed red color; however, upon the addition of acetic acid, first a green, then a blue color is produced. Compare *Le Noble*.

Léger's reagent for bismuth is a solution of cinchonine nitrate with potassium iodide, in which solutions of bismuth salts produce a dark-red precipitate.

Lehmann's test for glucose. Dissolve the substance in alcohol, add alcoholic potash, then copper sulphate solution, and warm. In the presence of glucose, separation of red cuprous oxide results.

Le Noble's reaction for acetone in the urine. Upon adding sodium nitroprussiate and ammonia to urine containing acetone, a violet color gradually forms. Compare *Légal's* test.

Leismer's test for sugar in the urine. 5 ccs. of a 0.1 p. c. solution of safranine, 1 cc. urine, and 2 ccs. soda lye are heated to boiling. In the presence of grape sugar, the solution is decolorized.

Lenz's reaction for pilocarpine. Upon rubbing up the alkaloid or its chloride with 100 parts of calomel, a gray to black color is produced, due to the reduction of the calomel. According to *Nagelvoort*, in the case of pilocarpine nitrate, the free base must first be separated with ammonia, and extracted with chloroform, after which the residue left upon evaporation of the $CHCl_3$ is treated as above.

Lepage's reagent for alkaloids. See *Marmé's* reagent.

Letheby's aniline reaction. Aniline yields a blue color upon heating to 50° C. with MnO_2 and dilute sulphuric acid.

Lewin's test for biliary coloring matter. The urates separating out upon strongly cooling urine are filtered out, washed, dissolved in hot water and this solution tested for coloring matter from the bile. See *Gmelin*.

Lewin's modification of *Baudouin's* test. See *Baudouin*.

Lex's phenol reaction. Upon adding to an ammoniacal phenol solution a solution of a hypochlorite (chlorinated lime sol. 1 : 20), or of bromine water (Cotton's modification), a green color is produced, changing to blue upon warming.

Lieben's acetone test. Add to the solution to be tested (e. g., to the distillate from urine) a solution of iodine in potassium iodide and a few drops of caustic potash solution, whereby in the presence of acetone iodoform is formed. Alcohol gives the same reaction. See *Gunning's* test.

Liebermann's reaction for cholesterin. According to *Burchard*, a solution of cholesterin compounds in acetic acid anhydride, with the addition of chloroform, is colored rose-red by concentrated sulphuric acid. The color rapidly changes to blue and green.

Liebermann's phenol reaction. Upon warming phenol with sulphuric acid in which 5% sodium nitrate has been dissolved, a blue color is produced. The addition of water causes a brown precipitate.

Liebermann's reaction for diazo and nitroso compounds. These become intensely colored upon the addition of a mixture of phenol and sulphuric acid.

Liebig's hydrocyanic acid test. Upon evaporating hydrocyanic acid with ammonium sulphide after the addition of a few drops of caustic potash solution, dissolving the residue in water, this solution after acidulating slightly with hydrochloric acid, becomes blood-red when treated with a little ferric chloride solution.

Liebig's quinine test. Upon shaking 0.5 g. of quinine sulphate in a stoppered test tube with 5 ccs. of ether (sp. gr. 0.728) and 1 cc. ammonia, two clear layers should form after standing. A turbidity indicates cinchonine or allied alkaloids. Compare the more delicate tests of *Kerner, Schaefer* and *De Vry*.

Liebig's test for cystine. The cystine prepared from the sediment of urine yields a black precipitate of PbS upon boiling with a solution of lead oxide in soda lye.

Lifschuetz's mixture for dissolving cellulose consists of sulphuric and nitric acids.

Linde's test for glycerine (separated from fluid-extracts).

1. The solution is rendered slightly alkaline with dilute solutions of sodium carbonate, and then mixed with powdered borax upon a watch crystal. If glycerin is present, a small quantity of the mixture introduced into an alcohol or gas flame upon a platinum wire will color the flame green.

2. Red litmus paper is saturated with a concentrated borax solution and thereby turned to blue. Upon moistening this paper with the glycerine solution previously rendered slightly alkaline, the red color reappears more or less rapidly, depending upon the concentration of the glycerine solution.

Compare *Hager's* glycerine reaction.

Lindo's reaction for alkaloids. The alkaloid is dissolved in dilute sulphuric acid, after which some ferric chloride is added. Concerning the resulting color reactions, see *Hager*, Pharm. Praxis III, 64.

Lindo's reaction for nitrates and nitrites. 0.5 ccs. of a solution of a nitrate or nitrite gives a purple color upon the addition of a drop of HCl

(15 p. c.), a drop of resorcin solution (10 p. c.), and 2 ccs. of pure concentrated sulphuric acid.

Lindo's reaction for saccharin. Upon evaporating saccharin to dryness with concentrated nitric acid, treating the residue with a few drops of a solution of potassium hydroxide in 50 p. c. alcohol and warming, blue, violet, purple, and red colors will appear in succession.

Lipp's reaction for dextrin. A cold saturated solution of lead acetate is heated to 60° C. and enough lead oxide is added to solidify the mass. After some time the mass is extracted with water and the solution filtered. This solution causes a white precipitate when boiled with a solution of dextrin.

Loeffler's stain (alkaline methylene blue) for identifying tuberculosis bacilli consists of a mixture of 30 volumes of a concentrated alcoholic methylene blue solution with 100 volumes of potassa solution (1:10,000).

Livache's test for fatty oils consists in observing the increase in weight of oils when mixed with finely divided lead.

Loewe's solution for identifying glucose. Mix a solution of 16 g. copper sulphate in 64 g. water with 80 ccs. of soda lye (sp. gr. 1.34) and 6—8 g. glycerine. With solutions of glucose or with diabetic urine this reagent causes a red precipitate upon warming. For quantitative estimation the reagent is prepared as follows: 15.621 g. of cupric hydroxide (prepared from 40 g. of crystallized copper sulphate) is warmed while still moist, with 30 g. glycerine, 80 ccs. soda lye (sp. gr. 1.34) and 160 ccs. water until solution results, after which enough water is added to make the whole measure 1155 ccs. 10 ccs. of this solution correspond to 0.05 g. glucose. Compare *Fehling's* solution.

Loewenthal's reagent for glucose is a solution of 60 g. tartaric acid, 240 g. sodium carbonate and 5 g. crystallized ferric chloride in 500 ccs. of hot water. Glucose solutions or diabetic urine when boiled with this solution cause a brown precipitate.

Loof's reagent for morphine is *Froehde's* reagent in various concentrations, whereby various changes of color are produced. (For details see Apoth. Ztg., 1895, 449.)

Lochini's reagent for alkaloids is a solution of potassium bichromate in hot concentrated sulphuric acid. Veratrine gives a yellow coloration with this reagent.

Luecke's test for hippuric acid. Upon heating the residue obtained by boiling to dryness a

mixture of hippuric and concentrated nitric acids, a strong odor of nitrobenzene is developed.

Lugol's solution for identifying albumen in the urine is a solution of iodine in potassium iodide which has been acidulated with glacial acetic acid.

Lunge's test for nitrous acid depends upon *Griess'* reaction (q. v.) with sulphanilic acid and *a*-naphthylamine, which according to *Lunge* are kept on hand dissolved in dilute acetic acid. Solutions containing nitrous acid are colored red with this reagent. For quantitative determinations the following is used:

Lunge & Lwoff's test for nitrous acid. Colorimetric test by means of a solution of 0.1 g. *a*-naphthylamine in 100 ccs. water, 5 ccs. glacial acetic acid and 1 g. sulphanilic acid in 100 ccs. water. The normal solution contains $\frac{1}{100}$ mg. nitrogen from nitrites per cc. (0.0493 g. sodium nitrite are dissolved in 100 ccs. water and 10 ccs. of this solution diluted to 100 ccs. with concentrated sulphuric acid). Place in each of two cylinders 1 cc. of the reagent and 40 ccs. of water; then add to one 5 g. of crystallized sodium acetate and to the other 1 cc. of a normal solution of the substance to be tested, and compare the colors.

Lunge & Lwoff's test for nitric in the presence of nitrous acid; a colorimetric determination by means of a solution of 0.2 g. brucine in 100 ccs. of pure concentrated sulphuric acid. Mix 1 cc. of normal solution (10 ccs. of a solution of 0.0721 g. KNO_3 in 100 ccs. water are diluted to 100 ccs. with concentrated sulphuric acid), and 1 cc. of the solution to be tested, each with 1 cc. of brucine solution; dilute each sample to 50 ccs. with concentrated sulphuric acid, heat to 70°—80° C., cool after the solutions have acquired a sulphur-yellow color, and compare the intensities of the colors in suitable glass cylinders.

The above normal solution contains per cc. $\frac{1}{100}$ mg. nitrogen from nitrates.

Lustgarten's reactions for iodoform.

1. Upon warming 1—2 drops of an iodoform solution with a little phenol and caustic potash, a red substance is formed, dissolving in alcohol to a red solution.

2. Dissolve 0.1 g. resorcin and a piece of sodium in 5 ccs. alcohol. 5 drops of the resulting green solution are mixed in a test tube with the ethereal iodoform solution, and the ether carefully evaporated. A cherry-red color results, which is destroyed by acids but restored by alkalies.

Lustgarten's reaction for naphthol. See *Wolff's* reaction.

Lux's test for fatty oils in mineral oils. In a paraffin bath kept at 200—210° C., heat for 15 minutes two samples of the oil contained in test-tubes, to one of which has been added some caustic soda, to the other some metallic sodium. Even if the specimen contains only 2 p. c. of fatty oil, one or the other sample, but generally both, will form a stiff jelly.

Lyon's mixture for shaking out strychnine and brucine consists of 3 volumes of ether and 1 volume of a mixture of 88 ccs. chloroform, 12 ccs. alcohol and 2 ccs. ammonia.

MacLagan's cocaine test. 50 ccs. of an approximately 0.1 p. c. solution of a cocaine salt are treated with 2—3 drops of ammonia, and the walls of the glass vessel rubbed vigorously with a glass rod. Pure cocaine separates out in crystals; a milky turbidity indicates the presence of amorphous alkaloids (isatropylcocaine).

Maisch's test for curcuma. See *Houvier's* test.

Mandelin's reagent for alkaloids is a solution of 1 g. ammonium vanadate in 200 ccs. concentrated sulphuric acid. This reagent yields brown, red, or green colorations with alkaloids.

Mangini's reagent for alkaloids is obtained by treating 3 parts of potassium iodide and 16 parts of bismuth iodide with 3 parts of hydrochloric acid. A brown precipitate is formed with solutions of alkaloids; compare *Dragendorff's* reagent. The above reagent has the advantage over the latter of not becoming turbid when mixed with water.

Mann's reagent for water in alcohol, air, etc. 1 p. of molybdic acid is triturated with 2 p. of citric acid, the mixture fused, and when cool dissolved in water; filter-paper is then saturated with this solution and dried at 100° C. This blue paper becomes white through the absorption of water when exposed to moist air, or when dipped into alcohol or ether containing water.

Maréchal's test for coloring matter from the bile. Add 2—3 drops of tincture of iodine to an acid or neutral urine; in the presence of biliary pigments a chrome-green color appears. See *Smith*.

Marmé's reagent for alkaloids (potassium cadmium iodide). Add to a boiling concentrated solution of potassium iodide (4 p. KI in 12 p. water) cadmium iodide to saturation (2 p.), and mix this with a like volume of a cold saturated solution of potassium iodide. The concentrated solution is permanent; the weak one decomposes upon standing. With solutions of alkaloids, this

reagent yields white to yellowish precipitates. (*Dragendorff*, Ermittelung der Gifte; *Hager*, Pharm. Praxis.)

Known also as *Lepage's* reagent.

Marque's test for sparteine. Sparteine sulphate warmed with one-third its weight of chromic acid, yields a green color through reduction of the latter; at the same time the penetrating odor of cicutin is developed.

Marsh's test for arsenic. By reduction with pure zinc and dilute sulphuric acid, arsenious hydride (arsine) is produced from solutions of arsenates or arsenites which must be free from oxidizing agents. If the arsine is passed through a red-hot glass tube, metallic arsenic is deposited on the cold portion of the tube beyond. Upon igniting the arsine and placing a cold porcelain plate into the flame, metallic arsenic is deposited upon the plate. (Concerning further tests, distinction from antimony, and precautious to be observed in manipulation, see *Fresenius*, Qualitative Analysis, and *Hager*, Pharm. Praxis.)

Davy's modification of the above consists in the use of sodium amalgam instead of zinc and sulphuric acid for the reduction of the arsenic compounds.

In *Himmelmann's* modification, zinc, iron, and concentrated ammonium chloride solution are used to accomplish this result.

Fleitmann's modification employs zinc and caustic soda or potash to liberate the arsine.

Masin's solution is a solution of potassium mercuric iodide of almost the same composition as *Mayer's* reagent (q. v.).

Masset's test for biliary coloring matter. See *Gmelin's* reaction.

Maugin's reagent for the microscopical examination of textile fabrics is an ammoniacal oxychloride of ruthenium (ruthenium red).

Maumené's reaction for distinguishing oils. Observe the rise in temperature which results when mixing the oil with concentrated sulphuric acid. Drying oils evolve much more heat than non-drying ones.

Maumené's test for glucose. Saturate woolen threads with a 33 p. c. solution of zinc chloride and dry. When moistened with a glucose solution and heated to 130°, the threads are colored brown or black.

Mayer's reagent for alkaloids (*Mayer's* solution, potassium mercuric iodide). 13.546 g. mercuric chloride and 49.8 g. potassium iodide are dissolved in water and diluted to 1 liter. With

most alkaloids in weakly acid solutions this reagent yields whitish precipitates, which property permits its use in quantitative determinations. (*Dragendorff*, Analyse der Pflanzen; *Dragendorff*, Werthbestimmung; *Hager*, Pharm. Praxis.)

This reagent is also known under the names: *Delf's* reagent, *Planta's* reagent, *Tauret's* reagent, *Winkler's* reagent.

Méhn's reagent for albumin is a mixture of 1 p. phenol, 1 p. acetic acid and 2 p. of 90 p. c. alcohol; this solution precipitates albumen in the presence of nitric acid or sodium sulphate. The best method of proceedure is to add an equal volume of a saturated solution of Glauber's salt to the urine to be tested.

Melassez's solution for the preparation of *Teichmann's* hæmin crystals is a solution of the same specific gravity as blood (1.050—1.057); it consists of 3.75 p. mucilage of acacia, 1.875 p. sodium sulphate, 1.03 p. sodium chloride and 100 p. water.

Merget's test for the presence of mercury. A piece of gold-foil upon which metallic mercury has been precipitated (e. g., by means of stannous chloride from urine containing corrosive sublimate) is wrapped up first in tissue paper, and then in filter paper which has been saturated with an ammoniacal silver solution and subsequently dried. The whole is weighted down; in the presence of mercury, a brown color will be produced in a few minutes on the inside of the filter paper.

To prove the presence of mercury vapor, draw lines on filter paper by means of a glass rod moistened with an ammoniacal silver nitrate solution. These are darkened by mercury vapor.

Merget's test for moisture depends upon the use of salts which, like palladous chloride and mercurous chloride, show a different color when moist than when dry.

Compare *Mann's* reagent.

Merz's test for olive oil. Of two samples of olive oil, one is heated to 250° C. In the case of pure olive oil, the heated sample will appear much paler than the other.

Mesnard's reagent for identifying albumens: glycerine containing sugar, and fumes from concentrated hydrochloric acid.

Messinger's test for acetone. Solutions containing acetone yield iodoform when treated with iodine and caustic soda. For quantitative estimations, either the iodoform is weighed (*Krämer*), or the excess of iodine found by titration (*Messinger*).

Meyer's thiophene reaction. Thiophene and its homologues are colored blue by a solution of isatin in concentrated sulphuric acid.

Meyer's reaction for cod liver oil. Pure cod liver oil when shaken with $\frac{1}{10}$ its volume of a mixture of nitric and sulphuric acid (1:1), is first colored rose-red, then lemon-yellow. Other fish oils either do not show such a distinct transition, or give a brownish-yellow coloration.

Metzger's reaction for cocaine. Dilute aqueous solutions of cocaine salt after acidulating with hydrochloric acid yield orange-yellow precipitates with potassium chromate.

Millian's reaction for identifying linseed oil in olive oil. 40.0 g. olive oil are mixed with 60.0 g. of a 20 p. c. solution of potassium hydroxide in 70 p. c. alcohol, and heated on the water-bath until the alcohol has evaporated. The resulting soap is dissolved in warm water, the fatty acids are separated out by the addition of dilute hydrochloric acid, and these dissolved in 20 ccs. of 90 p. c. alcohol. If to this solution, after heating to 90°, 2 ccs. of a 3 p. c. alcoholic silver nitrate solution are added, a brown color will result if linseed oil was present in the olive oil.

Millian's modification of *Bechi's* test (q. v.).

Millon's reagent for albumens and phenols is prepared by dissolving mercury in an equal weight of fuming nitric acid (sp. gr. 1.4), first in the cold, later on by the application of a moderate heat, and then diluting the solution so obtained with two volumes of water. The reagent contains mercurous and mercuric nitrates as well as free nitric and nitrous acids. Albumens yield a brick-red precipitate with this reagent, especially after warming. Similar reactions are given by all compounds of the aromatic series that contain a single hydroxyl or methyoxyl group; a second hydroxyl or a nitro group in the ring change the reaction (*Nickel*). Thus resorcin yields a yellow, hydroquinone an orange, pyrogallol a brown coloration. Tannin and guaiacol are colored red, eugenol and vanillin violet.

Kintschgen-Gintl's modification of *Millon's* reagent: A solution of mercuric nitrate is treated with a little potassium nitrite, and the necessary quantity of nitric acid added just before using. The potassium nitrite must be freed from any carbonate it may contain (by passing nitrous acid through its solution).

Compare *Gallois'*, *Hoffmann's* and *Plugge's* reagent.

Millon's reagent for salicylic acid is a 10 p. c. solution of mercuric nitrate in dilute nitric acid;

this yields an intensely red coloration with salicylic acid.

Mitscherlich's reaction for phosphorus depends upon the luminosity of phosphorus vapor when phosphorus is distilled in the dark with a current of steam.

Mohr's reaction for free acids, especially for HCl (in the gastric juice) is a mixture of 20 ccs. of a 10 p. c. potassium sulphocyanate solution with 5 ccs. of a 5 p. c. solution of ferric acetate. Hydrochloric acid with this reagent produces a cherry-red color with a brownish tinge; more of the acid causes a chestnut-brown coloration. This test also goes by the name of *Rheoch's* test.

Mohr's test for glucose. See *Moore's* test.

Molisch's reaction for carbohydrates. Shake ¼—1 cc. of the solution to be tested with 2 drops of a 15—20 p. c. alcoholic solution of *α*-naphthol or thymol. Upon the addition of a like volume of concentrated sulphuric acid, the solution is colored violet (furfurol reaction) in the presence of carbohydrates (and several other substances). Upon the addition of water, a bluish-violet precipitate is produced, which is soluble to a yellow solution in alcohol, ether or potash lye.

Moore's test for glucose and sugar in the urine. Upon heating glucose solutions or diabetic urine with caustic potash, a brown coloration results; after acidifying with some acid, the odor of caramel appears. This test is also known as *Mohr's* or *Pelouze's* test. Compare also *Heller's* test.

Mueller's test for cystin. Upon dissolving cystin (prepared from the sediment of urine) in caustic potash, diluting this solution with water, and adding sodium nitroferricyanide, a purple-violet color is produced.

Mueller's solution for hardening microscopic preparations is a solution of 20 g. potassium bichromate and 10 g. sodium sulphate in 1 liter of water.

Mulder's test for glucose. Upon heating diabetic urine or any solution of glucose with a solution of indigo in sulphuric acid, and then carefully neutralizing with sodium carbonate, the color changes into green, then red and finally yellow, due to reduction of the indigo. Upon exposure to the air, the blue color is restored.

According to *Vogt's* modification, litmus is used instead of indigo; *Neumann-Wender's* test (q. v.) employs methylene blue.

Mulder's xanthoprotein reaction. Upon heating any albuminous substance with concentrated nitric acid, it is partially or completely dissolved to a yellow solution. In the case of albumoses and

peptones this color is produced even in the cold. Upon supersaturating with ammonia or with fixed alkalies the color changes to orange-yellow.

Musculus' reagent for urea (ferment-paper). Decomposing urine is filtered, the filter washed, colored with curcuma, and preserved as test-paper. When added to solutions of urea, the attached ferment causes a splitting up of the urea, and the resulting ammonium carbonate causes the curcuma coloring matter to turn brown.

Neelsen's carbolfuchsin for identifying tubercle bacilli in the sputum is prepared by adding a concentrated alcoholic fuchsin solution to a 5 p. c. aqueous solution of carbolic acid (5 g. of crystallized carbolic acid are dissolved in 100 cc. of water and 1 g. fuchsin, dissolved in 10 g. alcohol, is added). *Erlich's* and *Ziel's* carbolfuchsin solutions have similar compositions.

Nessler's reagent for aldehyde. Aldehydes when treated with *Nessler's* ammonia reagent (q. s.) or with a solution of potassium mercuric iodide and baryta water, yield brownish-black precipitates, which differ from the precipitates caused by the same reagents in ammonia solutions, by being insoluble in potassium cyanide.

Nessler's reagent for ammonium salts is an alkaline solution of mercuric chloride and potassium iodide. With ammonia as well as with ammonium salts it causes a yellow to reddish-brown coloration or precipitate. The reagent is prepared according to various formulae, of which the following are typical:

I. 50 g. potassium iodide are dissolved in 50 cc. hot water and concentrated mercuric chloride solution (20—25 g. mercuric chloride) added until a permanent precipitate appears. After filtering, 150 g. potassium hydroxide dissolved in 300 ccs. water are added, and the whole diluted to one liter. 5 cc. more of the mercuric chloride solution is now added, the resulting precipitate allowed to settle, and the clear liquid decanted (*Kubel*).

II. Dissolve 2 g. potassium iodide in 5 g. water; add 4 g. of mercuric chloride, or enough so that upon warming a little of the precipitate remains undissolved. After cooling, dilute with 20 g. water, filter, and add 30 ccs. of a solution of 1 p. KOH in 2 p. of water. (*Ludwig.* Medicin. Chemie.)

Nessler's reagent for wine pigments is a solution of 7 p. alum and 10 p. sodium acetate in 100 p. water.

Neubauer's test for biliary acids is a modification of *Pettenkofer's* reaction. A few drops of urine are evaporated to dryness on the water-bath, a drop of sugar solution (1:500) and a drop of

concentrated sulphuric acid are added, and the whole heated on the water-bath. If biliary acids are present, a violet-red color appears at the edge.

Neubauer's test for chloroform in the urine. A current of air is passed first through the urine in question, then through a red-hot porcelain tube, and finally through a solution of silver nitrate. If chloroform was present in the urine, a precipitate of silver chloride is formed.

Neumann-Wender's alkaloid reagent is furfurol-sulphuric acid (5 drops of furfurol in 10 ccs. pure concentrated sulphuric acid). See *Weppen's* veratrin reaction.

Neumann-Wender's test for grape sugar in the urine. 1 cc. of diluted urine (1 p. urine to 10 p. water) is treated with 1 cc. each of methylene blue solution (1:1000) and normal KOH solution and boiled for a minute. If the solution is hereby completely decolorized, sugar was present in the urine. Compare *Mulder's* test.

Nickel's test for mineral acids in the presence of organic acids depends upon the fact that only the presence of the former is wood stained by phloroglucin. If 0.5 p. c. of hydrochloric acid is present in vinegar, upon adding phloroglucin and a piece of pine wood or wood-pulp paper, this latter is distinctly stained upon boiling the solution.

Nickel's color reactions of carbon compounds. Compare Zeitsch. f. analy. Chem. 1889, p. 244; also see under *Millon's* reagent.

Nivière and **Hubert's** test for fluorine in wine. Render the wine slightly alkaline with ammonium carbonate and, by means of calcium chloride, precipitate any fluorides present as calcium fluoride. After heating the incinerated residues with silicic and sulphuric acids, fluorine is identified in the usual manner as silicium fluoride.

Noll's reagent is a solution of sodium hypochlorite.

Nylander's reagent for glucose. 2 g. bismuth subnitrate and 4 g. Rochelle salts are dissolved in 100 g. of an 8 p. c. solution of caustic soda. To 10 p. of the solution to be tested (diabetic urine) add 1 p. of reagent, and boil. A darkening of the liquid due to reduction of the bismuth salt indicates glucose. This solution is also known as *Almén's* solution.

Obermeier's reaction for indican. The urine is treated with lead acetate, the resulting precipitate filtered out, and the clear filtrate shaken with a ½ p. c. solution of ferric chloride in fuming hydrochloric acid (sp. gr. 1.19). Upon extracting with chloroform, this is colored blue if indican was present.

Olivier's test papers for identifying albumen and sugar in the urine, are filter papers saturated with well-known reagents for albumen and sugar.

Test-papers for albumen: picric and citric acids; sodium tungstate and citric acid; potassium mercuric iodide and citric acid; papers separately saturated with potassium ferrocyanide and citric acid.

Test-papers for sugar: indigo-carmine and sodium carbonate, separate.

These papers also go by the name of *Geissler's* test-papers. For particulars see Ph. Centralh., 24, p. 431; 25, p. 3.

Ost's copper solution for estimating sugar, contains 23.5 g. cryst. cupric sulphate, 250.0 g. sodium carbonate, and 100.0 g. potassium bicarbonate per litre.

Compare *Soldaini's* solution.

Otto's reaction for picrotoxin. The yellow solution of the alkaloid in concentrated sulphuric acid shows a reddish-brown color at the zone of contact with a drop of potassium bichromate solution; upon mixing, the solution is colored green.

Otto's morphine reaction. With a solution of hydrochloric acid, ferric chloride, and potassium ferricyanide, morphine solutions yield precipitates of Prussian blue.

Otto's modification of *Fehling's* solution (q. v.) is a solution of 1 p. copper sulphate and 3 p. tartaric acid, to which enough caustic soda solution is added to just produce a clear solution.

Pacini's solutions, Nos. I and II, are preservative solutions for microscopic sections, and have the following composition:

I.		II.	
Mercuric chloride,	1 p.	Mercuric chloride,	1 p.
Sodium chloride,	2 p.	Acetic acid,	2 p.
Glycerin (25° Bé),	13 p.	Glycerin (25° Bé),	43 p.
Water,	113 p.	Water,	275 p.

Pagel's test for phosphorous acid in phosphoric acid. Phosphorous acid, upon warming with mercuric chloride solution, gives a white precipitate of mercurous chloride.

Panum's test for albumen. Any liquid (as urine) containing albumen, yields a coagulum when boiled with a like volume of a saturated solution of sodium sulphate or sodium chloride.

Paul's reaction for biliary coloring matter. If normal urine (or urine containing sugar or albumen) is colored with methylviolet, the color remains unchanged; if, however, the urine con-

tains biliary pigments, the violet color is changed to blood-red.

Papassyli's reaction for cane sugar. See *Reich's* reaction.

Pavi's solution for estimating glucose. 4.158 g. crystallized copper sulphate, 20.4 g. Rochelle salts, and 20.4 g. caustic potash are dissolved in water; 300 ccs. ammonia water (sp. gr. 0.88) are added, and the whole diluted to one litre. 10.0 ccs. of this solution represent 0.005 g. glucose. When all the cupric salt has been reduced to cuprous, the solution is colorless.

Compare *Fehling's* solution.

Pellagri's morphine reaction. Dissolve morphine in concentrated hydrochloric acid, add a few drops of concentrated sulphuric acid, and heat on the water-bath. A distinct purple coloration results. Now add some more hydrochloric acid, then sodium bicarbonate to a neutral reaction, and finally an alcoholic solution of iodine; the liquid is colored a deep chrome-green.

Pellet's solution for estimating glucose. 68.7 g. copper sulphate, 200 g. sodium chloride, 100 g. anhydrous sodium carbonate, and 6.87 g. ammonium chloride are dissolved in hot water and diluted with water to 1 litre. 10 ccs. of this solution are reduced by 0.05 g. glucose.

Compare *Fehling's* solution.

Pelouze's test. Same as *Moore's* test.

Penzoldt's test for acetone in the urine. A few crystals of ortho-nitrobenzaldehyde are dissolved in water and added to the distillate from urine, which is then rendered alkaline with caustic soda. In the presence of acetone the mixture becomes yellow, then green, and after several minutes indigo separates out.

Penzoldt's test for sugar in the urine, by means of *Ehrlich's* reagent. The urine is rendered strongly alkaline, and treated with a solution of diazobenzolsulphonic acid (1:60); at the same time a control test is made using normal urine. The latter is colored yellowish-red by the reagent; diabetic urine soon becomes dark red and opaque.

Penzoldt's test for naphthalene in urine. If 1 cc. of concentrated sulphuric acid is added to a trace of urine containing naphthalene; the urine floating on top of the acid will be colored dark green. Upon standing, the acid will assume the same color.

Perenyi's solution for hardening microscopic preparations consists of 4 volumes of 10 p. c. nitric acid, 3 vol. of alcohol, and 3 vol. of a 0.5 p. c. solution of chromic acid.

Perrot's reagent for ethereal oils is a solution of dimethylanilinviolet in glacial acetic acid and dilute alcohol. With many ethers, aldehydes, phenols, etc., this reagent gives characteristic colorations, but does not react with fatty oils or hydrocarbons. On this account this reagent can be employed to detect many adulterations of ethereal oils.

Persoz's solution for distinguishing textile fibres is prepared by shaking a solution of 10 g. zinc chloride in 10 g. water, with 2 g. of zinc oxide. Upon digesting any fabric in this basic zinc chloride solution at 30°—40°, any silk contained therein is dissolved.

Pettenkofer's reaction for biliary acids. Upon adding cane sugar and concentrated sulphuric acid to a solution of biliary acids (in the urine), an intense purple coloration is produced.

Strassburg's modification. Dissolve some cane sugar in the urine, saturate filter paper with this solution, and after drying, bring the paper in contact with a drop of sulphuric acid. The red color is then to be observed in translucent light.

Drechsel's modification consists in the use of phosphoric acid (instead of sulphuric acid) and warming.

Udransky's modification. Instead of cane sugar and sulphuric acid, furfurol-sulphuric acid is employed.

See also *Neubauer's* test.

By reversing the process, *Pettenkofer's* reaction can also be employed in testing for sugar; e. g., in glucosides. See *Brunner's* reaction for digitalin.

Piria's tyrosin reaction. The sediment from the suspected urine is warmed with a little concentrated sulphuric acid, diluted, neutralized with calcium carbonate, and the filtrate treated with ferric chloride solution. If tyrosin was present, the solution is colored violet.

According to *Piria-Staedeler*, the urine sediment is warmed with a little concentrated sulphuric acid, the solution diluted, neutralized with barium carbonate, boiled, filtered, and added, drop by drop, to a dilute solution of ferric chloride.

Planta's alkaloid reagent. See *Mayer's* reagent.

Plugge's phenol reaction. A dilute phenol solution is rendered intensely red when boiled with mercuric nitrate solution containing a trace of nitrous acid. At the same time metallic mercury separates out, and an odor of salicylol is developed. Compare *Fresenius'* phenol reaction.

Plugge's reagent yields with albumen a red color similar to the one produced with *Millon's* reagent.

Plugge's reagent for gum ammoniac. 30 g. caustic soda are dissolved in water, the solution kept cool during the addition of 20 g. bromine, and then diluted to one liter. A drop of this solution, when added to an aqueous or alcoholic solution of gum ammoniac prepared with the addition of dilute soda lye, immediately causes a rapidly disappearing, beautiful violet color.

Podwyssotzki's reaction for emetine. With a drop of a saturated solution of sodium phosphouranate, emetine yields a brown coloration which turns to blue upon the addition of a drop of hydrochloric acid.

Pollaci's phenol reaction. Phenol turns brown upon treatment with chromic acid mixture.

Posner's reaction for peptone and albumins in urine. After rendering the urine alkaline, it is poured into a test-tube and a layer of very dilute, almost colorless copper sulphate solution carefully poured on. Peptone causes the formation of a violet zone even in the cold; albumin gives the same reaction upon warming.

Compare *Brücke's* and *Rose's* biuret reaction.

Poutet's reaction for fatty oils (elaidin reaction). Pour 10 g. of oil, 5 g. nitric acid (40—42° Bé), and 1 g. mercury into a test-tube, dissolve the mercury by shaking for three minutes, allow the mixture to stand 20 minutes, and again shake for a minute. Various fats show differences in color, and in the ease with which they solidify. Olive oil and peanut oil harden most rapidly.

According to other authorities, 50 ccs. of the oil are mixed with 12 g. mercury and 15 g. nitric acid (sp. gr. 1.35), by which treatment only olive oil and oil of almonds are solidified, all other oils remaining liquid.

Pradine's reagent for foreign coloring matters in wine is a saturated solution of ammonia gas in ether. Upon shaking this solution with wine, the foreign coloring matters are dissolved in the ether.

Preyer's test for carbon monoxide in the blood. 3—4 drops of the suspected blood are warmed for 5 minutes at 30° C. with 10 ccs. water and 5 ccs. potassium cyanide solution (1:2). While the spectrum of normal blood, when treated as above, looses the absorption line of oxy-hæmoglobin, and in its place shows a broad absorption band, the spectrum of carbon monoxide blood remains unchanged.

Payer's hydrocyanic acid reaction. The reagent employed is a very dilute alcoholic tincture

of guaiac resin, containing a trace of copper sulphate solution. Upon approaching this mixture, contained in a porcelain capsule, with a glass rod moistened with hydrocyanic acid, blue lines are formed in the liquid; upon stirring, the whole solution turns blue. Compare *Schönbein* and *Pagenstecher's* reaction.

Prollius' solution for extracting cinchona bark (for the determination of alkaloids) is a mixture of 88 p. ether, 8 p. absolute alcohol, and 4 p. water of ammonia.

Purdy's solution for estimating glucose contains 4.15 g. copper sulphate, 10 g. mannite, 20.4 g. caustic potash, 300 ccs. ammonia water (sp. gr. 0.88), 50 g. glycerin, and enough water to make 1 liter. 25 ccs. of this solution are reduced by 0.015 g. grape sugar.

Compare *Fehling's* solution.

Puscher's test for alcohol in ethereal oils. Into the bottom of a test-tube introduce a few drops of the ethereal oil and dust the upper portion of the tube with powdered fuchsin, or introduce the latter by means of a swab of cotton. Upon boiling, the alcohol evaporates first and dissolves the fuchsin to a red solution.

Rafaële's modification of *Spiegler's* reagent, (q. v.)

Raspail's reaction for albumens. These are colored red by sugar and concentrated sulphuric acid.

Compare *Schultze's* furfurol reaction.

Reich's reaction for cane sugar. Solutions of cane sugar when treated with cobalt nitrate solution yield a violet coloration upon the addition of soda lye. According to *Dupont*, this reaction is not interfered with by glycerin, milk sugar, glucose, or invert sugar; however, dextrin and gums should be removed by precipitation with lead acetate or baryta water.

Reichardt's test for arsenic in the urine. 200 ccs. of urine are concentrated with about 2 g. of caustic soda, the residue dissolved in a little water, acidulated with hydrochloric acid, and then tested in a *Marsh's* apparatus.

Reichardt's reaction for nitric acid (brucine reaction). Upon treating a solution of brucine in concentrated sulphuric acid, with a few drops of a solution containing nitric acid, a rose-red to deep red coloration appears. This reaction takes place even in dilutions of 1:100,000.

Reichert-Meissl's number indicates the number of ccs. of deci-normal sodium or potassium hydroxide solution necessary to neutralize the volatile fatty acids obtained from 5 g. of a fat,

when operating according to a definite special method. The *Reichert's* numbers formerly in vogue gave the figures for 2.5 g. of fat, and are therefore only half as large as the *Reichert-Meissl's* numbers.

Reichl's test for glycerin. Equal parts of glycerin, phenol and sulphuric acid are mixed and heated to 120°. After cooling, water is poured upon the brownish-yellow solid mass and ammonia added drop by drop, whereby the mass is dissolved to form a beautiful carmine-red solution.

Reichl-Mikosch's reagent for albumens consists of benzaldehyde and sulphuric acid containing ferric sulphate.

Reinsch's arsenic test. A solution of arsenous or arsenic acid in hydrochloric acid is reduced by metallic copper. A gray coating of copper arsenide is formed upon the metal. Antimony and mercury behave similarly; their absence must therefore be proved before the presence of arsenic can be decided upon. This test is also known as *Hager's* empirical arsenic test (kramato method).

Remak's solution for hardening microscopical preparations is a mixture of 50 ccs. aqueous copper sulphate solution (20 p. c.), 50 ccs. alcohol (25°), and 35 drops purified wood vinegar.

Renard's test for peanut-oil depends upon the isolation of arachic acid (melting point 74–75°) by means of the lead salt, which can be separated from lead oleate by extraction with ether. For particulars see Chem. Ztg., 1895, p. 451.

Reuter's test for *p*-amidophenetol in phenacetin. The phenacetin is melted with pure chloral hydrate; if a violet color appears, amidophenetol was present. (Even the purest commercial specimens show a slight rose tint.)

Reynold's test for acetone in the urine. The distillate from the urine is shaken with freshly precipitated mercuric oxide (from mercuric chloride and potassium hydroxide). If acetone was present, the filtrate will contain acetone-mercury in solution and will respond to the tests for mercury.

Rheoch's test for free mineral acids. See *Mohr's* test.

Richardson's reaction for *a*-naphthol. 0.04 g. of naphthol and 0.5 ccs. of normal sodium hydroxide solution are dissolved in 1—2 ccs. of water. Hereto is added a mixture of 0.05 g. sulphanilic acid dissolved in 5 ccs. normal sodium hydroxide solution, and 0.02 g. sodium nitrite dissolved in 5 ccs. normal sulphuric acid. *a*-naphthol under these conditions yields a dark blood-red color, which changes to brown upon the addition of

dilute sulphuric acid; β-naphthol causes only a reddish-yellow color.

Richmont's test for nitric acid. Mix the solution to be tested with concentrated sulphuric acid, cool, and pour on top a layer of ferrous sulphate solution. A purple to brown color indicates nitric acid.

Also called *Desbassin's* reaction.

Riegler's reagent for albumens is asaprol (calcium naphtholsulphonate). Albumens, albumoses, peptone, and pepsin are precipitated by this reagent in acid solutions, but the precipitates formed with the latter three dissolve upon warming.

Rinnmann's zinc test. When zinc oxide after moistening with cobaltous nitrate solution is strongly heated on charcoal, a green color results.

Ripart's solution, a mounting-medium for microscopy, consists of 75 p. camphor water, 75 p. distilled water, 1 p. glacial acetic acid, 0.3 p. cupric acetate, 0.3 p. cupric chloride.

Ritsert's glycerin test. Upon heating 1 cc. glycerin to boiling with 1 cc. of ammonia water, and then adding 3 drops of a 5 p. c. silver nitrate solution, no change should occur in the liquid within 5 minutes.

This test was intended to show the presence of arsenous oxide, as well as of acroleïn and formic acid; recent work however seems to have proved the test fallacious.

Ritsert's reaction for phenacetine. 0.1 g. phenacetine is boiled for a minute with 1 cc. concentrated hydrochloric acid, then diluted with 10 ccs. of water, filtered after cooling, and the filtrate treated with 3 drops of 3 p. c. chromic acid solution, whereupon the liquid gradually assumes a ruby-red color.

Ritsert's sulphonal reaction. Upon heating sulphonal with gallic or pyrogallic acid, the odor of mercaptan appears.

Robert's test for albumen. Upon pouring the suspected urine in a layer upon a concentrated solution of sodium chloride in 5 p. c. hydrochloric acid, a white zone will appear if albumen is present.

Robinet's morphine reaction. A neutral solution of a morphine salt, when treated with a dilute solution of ferric chloride containing some oxychloride, assumes a rapidly disappearing, blue color.

Roch's test for albumen in the urine. A salicylsulfonic acid solution yields a precipitate with albumen.

Rose's biuret reaction for albumens. If a solution of an albumen is rendered alkaline with

soda lye, and a dilute copper sulphate solution (17—18 g. crystallized cupric sulphate in 1 litre of water) added drop by drop with constant shaking, the solution assumes first a rose-red, then a violet, and finally a blue color, which latter appears of a decided reddish tint when compared with a normal alkaline copper solution.

Compare *Brücke's* biuret reaction and *Posner's* reaction.

Rosenbach's test for biliary coloring matter. Upon the careful addition of a few drops of 5 p. c. chromic acid solution, urine containing biliary pigments is said to turn green. Upon adding more of the test solution, a brown color appears.

See also *Rosenbach's* modification of *Gmelin's* test.

Rosenstiel's aniline reaction. See *Runge's* aniline reaction.

Rosin's test for coloring matter from the bile. Pour a few cubic centimeters of dilute iodine solution in a layer upon the suspected urine. In the presence of biliary pigments, a green ring forms.

Rossbach's test for poisons consists in testing the action of alkaloids upon infusoria. The intensity of the action depends upon the degree of dilution.

Roth's reagent for fatty oils. Sulphuric acid of sp. gr. 1.4, saturated with nitrous fumes and mixed with the oil to be tested, gives different results as regards color and solidification, depending upon the nature of the oil.

Compare *Poutet's* elaidin reagent.

Roussin's crystals. Nicotine in ethereal solution yields with an ethereal iodine solution an oily mass, from which ruby colored crystals, reflecting dark blue, gradually separate.

De la Royère's reaction for fatty oils. A few drops of the oil to be tested are treated with two drops of a fuchsin solution to which just enough alkali has been added to decolorize it. Fatty oils when so treated cause a red coloration, due to the free acids which they contain. According to *Halpher* this test has only a limited value, since mineral oils may also contain acids. On the other hand, the acids of the fats, e. g., in lubricators, might be neutralized by alkaline soaps. The presence of soaps, however, could be easily proved by a solution of Congo-red just colored violet by hydrochloric acid; such a solution turns red with soaps.

Rubner's reaction for glucose and milk sugar. The solution to be tested is treated with lead acetate and ammonia, and warmed. In the presence of the above named sugars, a red precipitate results.

Runge's aniline reactions.

a) Aniline solutions, in the absence of ammonium chloride, yield with chlorinated lime solutions a purple-red color, which changes to rose-red upon the addition of acids.

According to *Rosenstiel's* modification, in case the aniline is impure, ether is added after admixture of the chlorinated lime solution; this takes up the brown product formed, so that the aqueous solution remains of a pure blue color.

b) A pine shaving, moistened with a dilute solution of an aniline salt, is colored yellow.

Runge's reaction for cane sugar. Sugar is blackened upon concentrating it with dilute sulphuric acid. Of course, many other organic substances act likewise.

Sachsse's solution for determining grape-sugar contains 18 g. mercuric iodide, 25 g. potassium iodide and 80 g. potassium hydroxide per litre. The modified

Sacchse-Heinrich's solution contains only 10 g. potassium hydroxide for the above quantities. The grape-sugar solution (which should be about 5 p. c. strength) is added to the boiling reagent until all the mercury salt is reduced. As an indicator hydrogen sulphide is used, being added to a small portion of the solution after acidulating with acetic acid. 40 ccs. of the reagent are reduced by 0.1342 g. grape-sugar. (Concerning the reduction numbers of other sugars see Pharm. Centralh. 21, p. 211.)

Salkowsky's test for peptone in the urine. 50 ccs. of urine are acidulated with hydrochloric acid and phospho-uranic acid added. The precipitate formed is washed, warmed on the water-bath, dissolved with a little soda lye, and a few drops of 1—2 p. c. copper sulphate solution added. In the presence of peptone, a red color appears.

Salkowsky's test for carbon monoxide in the blood. Mix the suspected blood with 19 p. water and add an equal volume of soda lye (sp. gr. 1.34). If the blood contains carbon monoxide the mixture becomes turbid, at first whitish, then light red; after some time, red flakes separate out on the surface of the rose-colored liquid. Normal blood is colored a dirty brown by soda lye.

Salkowsky's cholestrin reaction. The substance to be tested, e. g., lanolin, is dissolved in chloroform and the solution shaken with concentrated sulphuric acid. In the presence of cholesterin, the chloroform becomes blood-red while the sulphuric acid assumes a greenish fluorescence. The reaction can also be applied as a zone-reaction,

in which case the presence of cholesterin causes a brownish-red zone.

This reaction was first mentioned by *Hager*.

Salkowsky's phenol reaction. Phenol solutions are colored blue or greenish by the addition of ammonia and a few drops of chlorinated lime solution.

Salkowsky's reaction for creatinin. See *Weyl's* reaction.

Sandlund's test for iodine in the urine. 5ccs. of urine are treated with 1 cc. sulphuric acid (1:5) and 2—3 drops of sodium nitrite solution (1.0 g. in 500 ccs.), and shaken with carbon bisulphide. In the presence of iodine (up to 0·001%), the carbon bisulphide becomes colored.

Schaefer's quinine test (oxalate test). 1.0 g. crystallized or 0.85 g. anhydrous quinine sulphate are dissolved in 35 ccs. of boiling water, whereupon a solution of 0.3 g. crystallized neutral potassium oxalate in 5 ccs. of water are added, and the whole made up with distilled water to 41.3 g. The vessel is now placed for half an hour into a water-bath of 20° C., shaking occasionally, and finally filtered through glass-wool. If the quinine was free from allied alkaloid, no turbidity should be produced upon the addition of a drop of caustic soda solution to 10 ccs. of the filtrate.

Schaefer's test for cinchonidine in quinine sulphate (tetrasulphate test), depends upon the slight solubility of cinchonidine tetrasulphate in alcohol. 1 g. quinine sulphate is dissolved in 9 g. absolute alcohol and 3 g. 5% sulphuric acid. After allowing this solution to stand for a day with occasional shaking, any cinchonidine present will have separated out as tetrasulphate. Upon dissolving this precipitate in water and precipitating with caustic soda solution, pure cinchonidine of melting point 199° C. can be obtained.

Schaefer's reaction for identifying nitrites in the urine. 3—4 ccs. of urine are decolorized with animal charcoal, and then treated with an equal volume of diluted acetic acid (1:10) and 2 drops of 5% potassium ferrocyanide solution. The solution is colored yellow if nitrites were present.

Schaefer's test for naphthol-yellow in cakes, pastry, etc. 10—20 g. of the material to be tested are broken up into crumbs and warmed with 40 ccs. of alcohol (50—60% by vol.). Naphthol-yellow colors the alcohol yellow; upon addition of hydrochloric acid this color disappears, while that produced by saffron would remain.

Schaffgot's solution for precipitating magnesia without the addition of fixed alkalies consists of 235 g. ammonium carbonate and 180 ccs. ammonia water (sp. gr. 0.92), diluted to one litre.

Schaer's test for blood. See *Hühnefeld's* turpentine solution.

Scheele's reagent for arsenous acid in a solution of copper sulphate in an excess of ammonia water; this produces a light-green precipitate with arsenites.

Scheibler's reagent for alkaloids in phosphotungstic acid, which produces precipitates similar to those caused by phospho-molybdic acid. (*Sonnenschein's, Jungmann's, De Vry's* reagent). The reagent is prepared by dissolving 100 g. sodium tungstate and 60—80 g. sodium phosphate in 500 ccs. of water acidulated with nitric acid; or according to *Otto*, by simply adding phosphoric acid to a solution of sodium tungstate.

Schell's reagent for cocaine. Upon mixing cocaine hydrochlorate with calomel and moistening with a little water, (even breathing upon the powders is sufficient), the mixture will be blackened by partial reduction of the mercury salt. Compare *Lenz's* reaction for pilocarpine.

Scherer's test for inosite. Upon evaporating an aqueous solution of inosite almost to dryness with nitric acid, treating the residue with ammonia and a trace of calcium chloride, and again concentrating, a rose-red solution results.

Scherer's test for brucine. Upon carefully evaporating bencine to dryness on platinum foil with nitric acid, and warming the residue with caustic soda solution, a yellow liquid remains which upon further heating forms an oily drop.

Scherer's test for phosphine in the excreta in phosphorus poisoning depends upon *Hager's* test (g. v.) by means of silver nitrate paper.

Schiff's cholesterin reaction. If cholesterin is mixed with concentrated sulphuric acid and then ammonia water added, a red coloration appears.

Schiff's uric acid reaction. An alkaline uric acid solution reduces silver nitrate or silver carbonate. Moisten filter-paper with silver nitrate solution, touch the moistened spot with a little dilute solution of sodium carbonate, and dip the paper so prepared into the solution to be tested. A black spot will appear if uric acid was present.

Schiff's test for urea. If a solution of urea (urine) is treated with furfurol and hydrochloric acid, a violet color is produced; upon standing, an insoluble brown mass separates out.

Schiff's reagent for aldehydes is fuchsin-sulphurous acid. See *Guyon's* reagent.

Schlagdenhauffen's reagent for distinguishing alkaloids from glucosides is a mixture of equal parts of a 3% solution of guaiac resin and a saturated mercuric chloride solution. Only alkaloids give a precipitate with this reagent in the cold or at 60—79° C.

Schlickum's arsenic test. Upon pouring the suspected solution in a layer upon a solution of 0.02 g. sodium sulphite and 0.4 g. stannous chloride in 3—4 g. concentrated hydrochloric acid, a yellow zone appears if arsenic is present.

Schlossberger's reagent for distinguishing textile fibres is a concentrated solution of freshly precipitated (still moist) nickelous hydroxide in ammonia. This solution dissolves silk, but neither wool nor cotton. Compare *Persoz's* reagent.

Schmidt's reagent for glucose is ammoniacal lead acetate solution, which causes a brownish-red precipitate upon warming with glucose solutions (diabetic urine). Cane sugar causes no reduction of the lead salt. Compare *Rubner's* reagent.

Schmidt's nitric acid reaction. Mix the solution to be tested with an equal volume of a solution of 20 drops aniline and 10 g. dilute sulphuric acid in 90 g. water, and pour this mixture in a layer upon concentrated sulphuric acid. If nitric acid was present, a light- to dark-red zone will appear.

Schmitt's test for saccharin in liquids. The strongly acidulated liquid is shaken out three times with a mixture of equal volumes of ether and petroleum ether, these extracts treated with caustic soda solution, evaporated to dryness, and the residue heated for half an hour to 250° C. The solid mass is then dissolved in water, acidulated with sulphuric acid and shaken out with ether. If saccharin was present it is found in the ethereal extract as salicylic acid, which after evaporation of the ether, can be identified by means of ferric chloride.

Schneider's arsenic test. Any arsenic that may be present in the suspected substance is separated as arsenous chloride by distillation with hydrochloric acid and ferric chloride, and is then identified by Marsh's test.

Schneider's test for potassium cyanate in potassium cyanide depends upon the formation of the sky-blue cobalt cyanate. From the highly concentrated potassium cyanide solution, the hydrocyanic acid is removed by means of carbonic acid, the potassium carbonate removed by the addition of alcohol, and the filtrate tested with cobalt acetate solution.

Schneider's test for foreign oils (from *Cruciferæ*) in olive oil. The oil is dissolved in 2 parts of ether, 5 ccs. of a saturated alcoholic silver nitrate solution added, and the mixture allowed to stand for twelve hours in a dark place. If any oils containing sulphur were present, the mixture will be darkened.

Schneider's reaction for bismuth. A solution of 3 parts tartaric acid and 1 part stannous chloride in a sufficient quantity of caustic potash solution gives a black precipitate with a solution of a bismuth salt.

Schoenbein's reaction for blood. See *Almén's* reagent.

Schoenbein's reaction for copper. A solution of a copper salt yields a blue coloration upon addition of potassium cyanide and tincture of guaiac.

Schoenbein's test-paper for ozone is filter paper saturated with potassium iodide starch-paste (10 p. starch, 200 p. water, 1 p. potassium iodide). This paper turns blue in an atmosphere containing ozone.

Schoenbein's reaction for hydrogen peroxide is identical with *Boettger's* reaction.

Schoenbein and **Pagenstecher's** reaction for hydrocyanic acid. Strips of filter-paper dipped into a 10 p. c. tincture of guaiac and dried, and subsequently moistened with 0.1 p. c. copper sulphate solution, turn blue in the presence of hydrocyanic acid. Compare *Payer's* test.

Schoenvogel's reaction for distinguishing animal from vegetable oils. Upon shaking with a concentrated borax solution, the latter, olive oil excepted, are said to form emulsions, while the former separate out sharply upon standing.

Schoenvogel's test for foreign fats in butter. 6 ccs. of a saturated borax solution and 5 drops of butter are shaken together at room temperature, or are warmed to the melting-point of the fat. Butter, beef-tallow, Provence oil, and mutton-tallow are said not to emulsify when so treated; all other fats do. Comp. *Levin*, Chem. Ztg., 1895, p. 1852.

Schott's white-lead paper = polka-paper. A sized paper, coated with white-lead, used as an external indicator in titrating solutions of metallic salts with sodium sulphide.

Schotten-Baumann's reagent is benzoyl chloride. See *Baumann's* reagent.

Schroeder's test for acetanilid in phenacetine. Boil 0.5 g. phenacetine with 6–8 ccs. of water, cool, filter out the crystallized phenacetine, boil the filtrate after addition of potassium nitrite and

dilute nitric acid, add a few drops of *Plugge's* reagent and boil again. If acetanilid was present, a red color will appear.

Schuchardt's reagent for hydrochloric acid in the gastric juice is concentrated tropæolin solution.

Schultze's cellulose reagent. A solution of 25 p. anhydrous zinc chloride and 8 p. potassium iodide is made in 8.5 p. water, after which as much iodine is added as will dissolve upon slight warming. This reagent colors pure cellulose blue.

Schultze's furfurol reaction for albumens. Upon adding a trace of sugar to a solution of albumens in moderately concentrated sulphuric acid, and warming to 60° C., a beautiful bluish-red coloration appears. See *Raspail's* reaction.

Schultze's maceration liquid, for isolating the individual elements of plant tissues, is nitric acid to which some potassium chlorate has been added. The tissues are boiled for a few seconds in the mixture, whereby the middle lamella is dissolved, after which much water is added.

Schultze's alkaloidal reagent is phosphoantimonic acid. This is prepared by dropping antimonic chloride into aqueous phosphoric acid, or by mixing 4 parts of a saturated sodium phosphate solution with 1 part antimonic chloride. With solutions of alkaloids, this reagent, similar to the related phosphomolybdic and phosphotungstic acids (see *Jungmann's*, *Scheibler's*, *Sonnenschein's* and *De Vry's* reagent), yields mostly white precipitates.

Schulz's salicylic acid reagent. A neutral solution of a salicylate causes a green coloration with copper sulphate solution.

Schumpelitz's veratrine reagent is a solution of fused zinc chloride in dilute hydrochloric acid. Upon evaporating a few drops of this reagent to dryness with veratrine, a red color results.

Schuster's test for coloring matter in beer. Pure beer is said to be decolorized by tannin solutions, while the color produced by caramel is not destroyed under these conditions.

Schwarz's sulphonal reaction. Upon heating sulphonal with charcoal, the odor of mercaptan is developed.

Schwarzenbach-Delf's reagent is potassium platinic cyanide.

Schwarzenbach-Delf's alkaloid reaction. Upon treating with nitric acid and subsequently with ammonia, many alkaloids give characteristic color reactions.

Schweissinger's reagent for alkalies is a solution of equal parts of iodine and tannin in

absolute alcohol. Even in very dilute aqueous solutions of alkalies (also carbonates), this reagent produces a red coloration.

Schweitzer's reagent for identifying soaps in lubricating oils is a saturated solution of metaphosphoric acid in absolute alcohol. In the presence of soap, the ethereal solution of the oil yields a white precipitate when treated with this reagent.

Schweizer's reagent for distinguishing textile fibres. Freshly precipitated, washed, and still moist cupric hydroxide or carbonate is shaken with ammonia water (20 p. c.) until a saturated solution results. This solution dissolves cotton, linen and silk, but not wool. The reagent is especially useful in microscopy, since it rapidly dissolves cellulose but has no action on lignin.

According to *Böttcher* this reagent can be prepared by allowing stronger ammonia water to again and again run in a thin stream over copper foil. *Wiesner* prepares it by allowing copper turnings to remain in contact with 13—16 p. c. ammonia water in an open bottle.

Seegen's test for grape sugar. See *Trommer's* test.

Seidel's reaction for inosite. The solution is evaporated to dryness with nitric acid and the residue treated with strontium acetate solution. Inosite causes a violet coloration.

Selmi's alkaloid reagent is prepared by diluting a saturated solution of iodic acid in concentrated sulphuric acid with 6 volumes sulphuric acid.

Another alkaloidal reagent proposed by *Selmi* is a solution of lead peroxide in concentrated hydrochloric acid.

Selmi's test for blood. The (blood-stained) object to be tested is extracted with ammonia, the filtrate precipitated with sodium tungstate and acetic acid, the precipitate after washing treated with a mixture of 1 vol. ammonia and 8 vol. absolute alcohol, filtered, the alcohol removed by evaporation, and the residue treated with sodium chloride and acetic acid. If blood was present, hæmin crystals can be found upon microscopical examination.

Silbermann's reaction for albumen. Albumen freed from fats gives a violet coloration upon heating with fuming hydrochloric acid.

Skraup's reaction for thallin. This substance yields an emerald green color when treated with oxidizing agents as chromic acid, bromine, iodine, mercuric nitrate, or ferric chloride.

Smith's modification of *Maréchal's* test (q. v.) for biliary pigments. Pour tincture of iodine carefully upon the suspected urine so that a zone reaction may be observed.

Snow's mixture for shaking out colchicine consists of 18 ccs. chloroform, 2 ccs. alcohol, 80 ccs. petroleum ether and 10—15 drops of ammonia water.

Soldaini's solution for identifying glucose. 15 g. cupric carbonate are dissolved in 1400 g. water with the aid of 416 g. potassium bicarbonate. Upon boiling this solution with solutions of glucose, cuprous oxide separates out. Compare *Ost's* copper solution.

Sonnenschein's reagents for alkaloids.

I. Cerous hydroxide is suspended in caustic potash solution and chlorine gas passed into the mixture until the formation of the brownish-yellow ceric hydroxide is completed, after which it is collected, washed, and dried. The alkaloid is dissolved in concentrated sulphuric acid and a trace of ceric hydroxide is added. Concerning the resulting color reactions, see *Hager*, Pharm. Praxis I, 207.

II. (Phosphomolybdic acid.) A solution of ammonium molybdate in nitric acid is precipitated with phosphoric acid, the precipitate washed, boiled with nitro-hydrochloric acid to decompose the ammonia, evaporated to dryness, and the residue dissolved in 10 p. c. nitric acid. This reagent yields yellow precipitates with weakly acid solutions of alkaloidal salts (also with ammonia and some other bases).

Compare *Jungmann's* reaction.

Souchère's test for peanut oil. The free fatty acids separated from the suspected oil are dissolved in boiling alcohol. If peanut oil was present, arachic acid separates out upon cooling in characteristic shining crystals.

Spicea's test for salicylic acid (in wine). The wine is extracted with ether; the residue left upon evaporation of the ether is warmed with concentrated nitric acid, then ammonia added in excess. If salicylic acid was present, it is hereby converted into picric acid, which can readily be identified by the yellow color which a woolen fibre assumes when dipped into the solution.

Spiegler's reagent for albumen consists of 8 g. mercuric chloride, 4 g. tartaric acid, 200 g. water and 20 g. glycerin. The suspected urine is acidulated with acetic acid, any resulting precipitate (mucin) filtered out, and the reagent poured in a layer upon the filtrate. In the presence of albumen, a white zone will appear. If the urine contained iodine, there would be found at the line

of contact a yellow flocculent precipitate, soluble in alcohol.

The delicacy of *Spiegler's* test depends upon the amount of chlorides in the urine. *Rafaële* therefore proposed to use hydrochloric instead of acetic acid. A reagent which is independent of the chloride content is *Jolle's* reagent (q. v.).

Stahl's reagent paper is filter paper saturated with a 1—5 p. c. cobaltous chloride solution. When dry, it is blue, in moist air it assumes a reddish color, and can therefore be used in hygroscopic determinations. Compare *Merget's* test.

Stas-Otto's extraction test for distinguishing alkaloids. The alkaloids are divided into three groups depending upon their property 1, of being taken up by ether from acid solutions; 2, of being taken up by ether from alkaline solutions; 3, of not being taken up by ether under either condition (morphine).

Stenhouse's caffeine reaction. Upon heating caffeine for a few minutes with fuming nitric acid, evaporating the yellow solution to dryness, and moistening the residue with ammonia water, a purple color results similar to that of murexid, but which disappears upon the addition of caustic potash (while the murexid color is thereby changed to blue).

Storch's test for rosin oil in oil mixtures. 1—2 ccs. of the oil are shaken with 1 cc. acetic anhydride, allowed to stand, the acetic anhydride separated by means of a pipette and treated with a drop of concentrated sulphuric acid. In the presence of rosin oil a violet-red color appears. *Morawski* recommends sulphuric acid of sp. gr. 1.53 instead of the concentrated acid.

Strassburg's reaction. See *Pettenkofer's* reaction.

Struve's test for blood. Suspected stains are extracted with dilute caustic potash solution, the solution filtered and tannin added. If blood was present, the solution is colored reddish-brown, and upon acidulating with acetic acid yields a precipitate which, after washing and treating with acetic acid and sodium chloride, yields hæmin crystals. (See *Selmi's* test and *Teichmann's* hæmin crystals.) Urine containing blood yields a reddish precipitate upon addition of caustic soda and tannin, and subsequent acidulating with acetic acid.

Stuetz's albumen-reagent capsules contain *Fürbringer's* reagent (q. v.).

Tanret's reagent for albumen. 3.32 g. potassium iodide and 1.35 g. mercuric chloride are dissolved in 20 ccs. acetic acid and diluted with water to 60 ccs. With albuminous urine this reagent

yields a white precipitate, insoluble in acetic acid. Peptones cause precipitates which redissolve upon boiling; alkaloids, precipitates soluble in alcohol. Compare *Mayer's* reagent.

Tattersal's morphine reaction. Upon addition of sodium arsenate to a solution of morphine in concentrated sulphuric acid, a dirty violet color results which changes to sea-green.

Codeine yields a blue color when so treated.

Teichmann's hæmin crystals as a test for blood. Treat 2—3 ccs. of an aqueous, not too dilute, solution of blood with a few drops of glacial acetic acid and a trace (0.01 g.) of sodium chloride. A few drops of the solution are evaporated on a cover-glass and the residue examined microscopically. The hæmin crystals are rhombic needles or plates of brownish-red to dark brown color.

For applications see *Struve's* and *Selmi's* test.

Thénard's test for aluminium compounds. Aluminium oxide (separated from compounds by igniting on charcoal, with the addition of sodium carbonates if necessary) yields *Thénard's* blue upon igniting with cobalt salts.

Thoulet's liquid is made by dissolving 1 part potassium iodide and 1.239 parts mercuric iodide in water and evaporating this until a pellicle commences to form. The solution then has a specific gravity of 3.196 and is used for the mechanical separation of the constituents of powdered minerals. Compare *Klein's* liquid.

Thresh's reagent for alkaloids is a solution of 1.8 g. potassium iodide in 45 ccs. hydrochloric acid and 30 ccs. of a bismuth solution (Liq. Bism. et Amm. Citr., Brit. Ph.) prepared as follows: 2.5 g. bismuth are dissolved in 70 g. nitric acid, 60 g. of nitric acid are added, then enough ammonia to render weakly alkaline, and enough water to make 600 ccs.

This reagent causes reddish-brown colorations and precipitates with alkaloids.

Tocher's modification of *Baudouin's* reaction for benne oil. 2 g. of pyrogallol are dissolved in 30 ccs. hydrochloric acid (sp. gr. 1.19?), and 15 g. of this solution shaken with an equal volume of oil. After standing and allowing two layers to form, the acid solution is removed by means of a pipette and warmed for five minutes. In the presence of benne oil, a blueish-red color appears.

Tollen's reagent for glucose is an ammoniacal silver solution, obtained by precipitating silver nitrate solution with caustic potash and adding enough ammonia to just dissolve the precipitate formed. This solution is reduced by glucose.

Tommasi's phenol reaction. See *Hoppe-Seyler's* reaction.

Topping's solution is used for imbedding microscopical preparations. It consists of a mixture of 1 p. absolute alcohol and 5 p. water, or in place of the latter, 4 p. water and 1 p. aluminum acetate. The solution is mixed with an equal volume of glycerin before using.

Traub's reagent for hydrogen peroxide is a zinc iodide-starch solution to which copper sulphate and some ferrous salt have been added.

Trapp's veratrine reaction. Upon boiling with concentrated hydrochloric acid, veratrine yields a permanent purple color.

Trommer's test for glucose. Upon adding 1—2 drops of copper sulphate solution and 4—5 ccs. of caustic soda solution to a dilute solution of grape sugar, the precipitate will dissolve and upon heating cuprous oxide separates out. Compare *Fehling's* solution.

For examining urine, this is rendered alkaline with soda lye, then cupric sulphate solution added drop by drop until a permanent precipitate appears. If glucose was present, the yellow cuprous oxide will form upon heating.

To remove other reducing agents that might be present, 10 ccs. of urine are boiled with 5 ccs. copper sulphate solution (1:10), 2 ccs. sodium carbonate solution (1:10) added to the cooled filtrate, the solution filtered after standing, and the filtrate tested according to *Trommer's* test. Compare *Johnson's* reaction.

Trotarelli's reaction for ptomaines. Upon adding sodium nitroferricyanide and subsequently palladium nitrate to the sulphuric acid salts of ptomaines, characteristic color reactions appear. Compare *Vitali.*

Trotarelli's alkaloid reaction. Upon evaporating with concentrated nitric acid and subsequently treating the residue with alcoholic potash solution, various alkaloids give characteristic color reactions. Compare *Vitali.*

Tscheppe's alcohol reaction. 70 p. c. nitric acid is poured in a layer upon the liquid to be tested. If alcohol was present, a green color will appear at the line of contact; after some time bubbles of gas will form and the odor of ethyl nitrite become apparent.

Tuchen's reaction for ethereal oils. Many ethereal oils fulminate when 4—6 drops of the oil are brought in contact with 0.1 g. iodine.

Udransky-Baumann's test for poly-acid alcohols (glycerin, carbohydrates) depends upon *Baumann's* reaction with benzoyl chloride and

sodium hydroxide. Since diamines also give this reaction, the presence of the first mentioned compounds must be confirmed by means of the furfurol reaction. See *Molisch's* reaction.

Uffelmann's reagent is a mixture of 1 drop ferric chloride solution, 0.4 g. alcohol, and 100 g. water. This reagent is decolorized by hydrochloric acid; lactic acid colors it yellow, butyric acid causes a milky turbidity.

Ultzmann's test for biliary coloring matter. 10 ccs. urine are shaken with 3—4 ccs. potassium hydroxide solution (1:3) and an excess of pure hydrochloric acid added. In the presence of biliary pigments the mixture assumes a beautiful emerald-green color.

Valenta's test for fats. Equal volumes of fat and glacial acetic acid (sp. gr. 1.0562) are intimately mixed in a test tube; if the oil does not dissolve in the cold, apply heat. 3 classes of oils are distinguished, depending upon whether solution results at ordinary temperatures, at temperatures up to the boiling point of glacial acetic acid, or whether even then, solution is incomplete. Further, in the case of oils dissolving upon application of heat, the temperature is observed at which, upon cooling, turbidity first appears.

According to *Bach*, the same observations made with *David's* alcohol acetic acid (q. v.) and the free fatty acids separated from the fats, give good results.

Valentine's reaction for fuchsin. Upon shaking ether with a solution containing fuchsin, the ether does not dissolve the coloring matter, but upon adding ferrous iodide, the ether is colored violet.

Valser's reagent is potassium mercuric iodide.

Van Deen's test for blood. Upon adding a few drops of freshly prepared tincture of guaiac resin and a little ozonized oil of turpentine to a highly diluted solution containing blood, a blue color results.

Vetere's test for castor oil. See *Di Vetere*.

Villavecchia and **Fabri's** modification of *Baudouin's* test for benne oil. Reagent: 2 g. furfurol in 100 ccs. alcohol.—10 ccs. oil are shaken for ½ minute with 0.1 cc. furfurol solution and 10 ccs. hydrochloric acid (sp. gr. 1.19). A red coloration indicates benne oil.

Villier and **Tayolle's** reagent for hydrochloric acid and chlorine. Even traces of chlorine cause in acid aniline solution (400 ccs. saturated aqueous aniline solution, 100 ccs. glacial acetic acid) brownish to black precipitates; with aniline solutions containing ortho-toluidin (100 ccs. satu-

rated aqueous aniline solution, 200 ccs. saturated aqueous ortho-toluidine solution, 30 ccs. glacial acetic acid), a blue coloration results. Bromine and iodine cause no color reactions with above mixtures, although bromine yields white precipitates. To apply this test to the halogen hydracids, the halogens are liberated from their combinations by heating with dilute sulphuric acid and potassium permanganate.

Violette's solution for testing for glucose is identical with *Fehling's* solution (q. v.).

Vitali's reaction for alkaloids. The alkaloid after addition of fuming nitric acid is evaporated to dryness on the water-bath, and the residue treated with a drop of alcoholic potash. Various alkaloids show characteristic color reactions: e. g., atropine shows a violet color; strychnine with a small amount of potash, a reddish-yellow, with a larger amount, a reddish-violet color.

Vitali's reaction for blood. The suspected stain is extracted with caustic potash solution, the solution acidulated with acetic acid, and tincture of guaiac added. If no blue color appears within ½—2 hours, the addition of oil of turpentine or of oil of eucalyptus will immediately bring out that color if blood was present.

Vitali's reaction for biliary pigments. See *Gmelin's* reaction.

Vitali's reaction for chloroform. A current of hydrogen (produced from pure zinc and dilute sulphuric acid) is passed through water and is ignited at the exit-tube, which should be tipped with platinum. The flame is colorless and no color is produced by the introduction of a copper wire. If now the suspected liquid is poured into the above water, in case chloroform (or any other volatile chlorine compound) is present, the flame will turn green upon introducing the copper wire.

Vitali's test for naphthol-yellow (butter color) in the urine etc.

1. The ethereal extract of the suspected liquid is evaporated to dryness; in the presence of naphthol-yellow, the residue is colored red upon treatment with potassium cyanide solution. If the ethereal solution is shaken with caustic potash solution and the latter then acidulated, woolen fibres which have been treated with alum as a mordant will be tinged yellow when dipped into the acid solution, even in the presence of only 0.000001 g. naphthol-yellow.

2. A solution of naphthol-yellow (even in urine) produces a green lake with cobaltous chloride and caustic potash.

3. The same solution when treated with stannous chloride and subsequently with ammonia, yields a white precipitate, which turns rose-red upon the addition of more ammonia.

Vogl's test for glucose. See *Mulder's* test.

Vogl's reaction for quinine. Upon treating with chlorine water and potassium ferricyanide, quinine gives a red coloration.

Vogl's reaction for chenopodium seeds in flour. Flour containing chenopodium seeds is colored rose to red upon digesting for a few hours with alcoholic hydrochloric acid.

Vry's quinine test. See *De Vry's* quinine test.

Vulpius' reaction for acetanilid. A few centigrammes of acetanilid are boiled in a test-tube with 1 cc. caustic potash solution, after which a drop of filtered chlorinated lime solution is suspended on a glass rod over the hot mixture. The drop is soon colored yellow (with a violet tinge by reflected light); upon further heating it turns violet.

Vulpius' sulphonal reaction. Upon heating sulphonal with potassium cyanide, the odor of mercaptan is developed. The fused mass yields a red color when treated with ferric chloride (sulphocyanate reaction).

Wagner's alkaloid reagent is a solution of iodine in potassium iodide (deci-normal iodine solution); it yields brown precipitates with aqueous solutions of alkaloidal salts.

Wagner-Fresenius' solution is an iodine potassium iodide solution.

Wayne's solution for identifying glucose consists of 2 g. copper sulphate, 10 g. caustic potash, and 10 g. glycerin dissolved in 200 g. water. Glucose reduces this solution upon warming, cuprous oxide separating out.

Weber's test for blood. The suspected liquid (urine) is treated with glacial acetic acid, shaken out with ether, the ethereal layer separated and treated with old resinified oil of turpentine and a few drops of freshly prepared 10 p. c. tincture of guaiac. In the presence of blood, a blue coloration results. Compare *Almén's* reagent.

Weidel's reaction for xanthine. Upon evaporating with chlorine water and a trace of nitric acid, xanthine leaves a yellow residue which is colored a deep yellowish-red by the action of ammonia vapors.

Weigert's solutions for staining bacteria are prepared by dissolving 2—4 g. methylene blue

(2 g. fuchsin or 2 g. victoria blue, respectively) in 15 ccs. alcohol, and diluting the solutions with 85 ccs. water.

Weissmann's acid mixture for dissolving iron samples consists of 10 volumes concentrated nitric acid, 2 volumes concentrated sulphuric acid and 10 volumes water.

Ulzer and *Brüll* also recommend the addition of a little concentrated hydrochloric acid while concentrating.

Welmann's reaction for vegetable fats.

Reagent: 5 g. sodium phosphomolybdate are dissolved in water, treated with concentrated nitric acid and diluted to 100 ccs.

Test: 1 cc. fat is dissolved in 5 ccs. chloroform and shaken for a minute with 2 ccs. of the reagent. In the presence of vegetable fats (cacao-butter excepted), a green color results which changes to blue upon addition of ammonia.

Wender's test for glucose. See *Neumann-Wender's* test.

Wenzel's reaction for alkaloids. These yield various colorations with a solution of 1 g. potassium permanganate in 200 g. sulphuric acid. Veratrine, e. g., yields first a light red, then an orange coloration.

Weppen's veratrine reaction. If a small quantity of veratrine is mixed with about six volumes of cane sugar and then a few drops of concentrated sulphuric acid be added, a yellow color results, changing to green and finally to blue. —*Neumann-Wender* employ instead of the sulphuric acid and cane sugar, a solution of furfurol in sulphuric acid. Morphine and codeine yield with either reagent unstable red colorations.

Weselsky's reagent is nitric acid saturated at a low temperature with nitrous acid.

Weselsky's reaction for phloroglucin. Upon adding toluidine nitrate and potassium nitrite to a phloroglucine solution, a light yellow color is first produced which gradually becomes opalescent, then orange, and finally cinnabar-red. In great dilutions the precipitate remains suspended for a long time; upon settling, the solution appears orange-red, the precipitate cinnabar-red. By means of this reaction, phloroglucine can be identified in solutions of 1:200,000.

Weyl's test for creatinin. Upon treating urine with a dilute solution of sodium nitroferricyanide and subsequently with caustic soda, it will assume, if creatinin is present, a beautiful red coloration which soon changes to yellow. The presence of other sulphur compounds interferes with the test.

Salkowsky adds acetic acid after the red color has appeared, and warms: the solution turns blue and Prussian blue separates out.

Jaffé also recommended the same test.

Wickersheimer's liquid, a preservative solution, consists of 100 g. alum, 25 g. common salt, 12 g. saltpetre, 60 g. potassium carbonate, and 20 g. arsenous acid, dissolved in 3 litres of water.

Wiederholt's reaction for pure rum and cognac. Upon treating 10 ccs. of the sample with 3 ccs. concentrated sulphuric acid (sp. gr. 1.84) and allowing the mixture to cool, the aroma of pure rum is retained, while in the case of the artificial product the aroma is destroyed.

Upon treating pure cognac with a few drops of dilute ferric chloride solution, a black precipitate is formed. Artificial cognac does not give this test; at the most, a dirt-colored precipitate slowly forms.

Wiesner's reagent for lignin is an acid solution of aniline sulphate; woody fibres are stained golden yellow by means of it, while pure cellulose is not affected. A 0.5 p. c. phloroglucine solution, which together with hydrochloric acid colors woody fibres yellow, is also known as *Wiesner's* reagent.

Wilson's reaction for nitrous acid in sulphuric acid. Add a granule of resorcin to the sulphuric acid and shake with 5 ccs. water. In the presence of nitrous acid a yellow coloration results.

Winckler's reagent. See *Mayer's reagent*.

Wolesky's test for wood fibre (in paper). 1 g. diphenylamin is dissolved in 50 ccs. alcohol and 5—6 ccs. concentrated sulphuric (or hydrochloric) acid. Depending upon the amount of wood fibre present in the paper, different intensities of orange-red will appear upon moistening with the reagent; the colorations become more prominent upon drying.

Wolff's reagent for naphthols. *α*- and *β*-naphthol dissolved in alcoholic potash yield upon heating with chloroform to 50° C., clear blue solutions, which change to red upon acidulating with hydrochloric acid. This reaction was first mentioned by *Lustgarten*.

Worm-Mueller's solution for identifying glucose is a modification of the old *Fehling's* solution. It consists of two separate solutions, viz., a 2.5 p. c. copper sulphate solution and a 4 p. c. caustic soda solution containing 10 p. c. of rochelle salt. 5 ccs. of the suspected urine on the one hand and 1—3 ccs. copper sulphate solution with 2.5 ccs. of the rochelle salt solution on the other are

separately heated to boiling and then mixed without shaking.

Fehling's solution (q. v.) according to recent formulæ is also prepared and kept on hand as two separate solutions.

Wright's reaction for aconitine. If 0.001 g. aconitine is distributed through a few drops of moderately concentrated sugar solution, and then a drop of concentrated sulphuric acid is added, a rose-red zone will develop at the line of contact of the sugar solution and the acid, which color rapidly changes to a dirty violet and brown.

Wurster's modification of *Silbermann's* albumen reaction (q. v.). In place of concentrated hydrochloric acid, a mixture of this with $\frac{1}{10}$—$\frac{1}{8}$ its volume of concentrated sulphuric acid is employed.

Wurster's "tetra"-paper for identifying ozone or hydrogen peroxide is filter-paper saturated with tetramethylparaphenylenediamine. Traces of ozone or hydrogen peroxide in neutral solutions or in solutions acidulated with acetic acid, cause an intense blue coloration of the paper. Upon boiling with alcohol the blue color disappears. Instead of the tetramethyl- the dimethyl-compound may also be employed.

Young's test for gallic in tannic acid consists in the addition of potassium cyanide, which gives a red coloration with the former, but not with the latter. According to *Stahl* this reaction can be referred entirely to the alkalinity of the potassium cyanide.

Yvon's reagent for determining the amount of alcohol in chloroform. 1 part potassium permanganate and 10 parts caustic potash are dissolved in 250 parts of water. This reagent was originally intended for testing for impurities in chloroform, on the supposition that upon shaking impure chloroform with the reagent, the violet color of the latter would be changed to green, but it was found that the prescribed alcohol content of chloroform would produce this change and the solution can therefore be employed in testing for this. Alcohol-free but impure chloroform stands the test.

Yvon's reaction for colchicine. See *Paul's* reaction.

Zacharias' reagent for albumens is acidulated potassium ferrocyanide solution and ferric chloride.

Zeisel's reaction for colchicine. Upon boiling a solution of 0.002 g. colchicine in 5 ccs. water for one to three minutes with the addition of 5—10 drops fuming hydrochloric acid and 4—6 drops ferric chloride solution (10 p. c.), the solu-

tion, originally yellow, turns olive-green and finally blackish-green. Upon shaking with chloroform in the presence of air, the chloroform assumes a ruby-red color, the aqueous solution remaining olive-green.

Ziel's solution. See *Neelsen's* solution.

Zuelzer's reaction for albumen is a zone reaction, occurring upon pouring a layer of albuminous urine upon concentrated chromic acid solution.

Zuelzer's reaction for grape sugar. A solution of cupric oxide in soda lye is reduced by grape sugar in the cold or upon gentle warming.

Zulkowsky's starch solution is prepared by heating starch with glycerin to 190°, precipitating with alcohol and dissolving the precipitate in water.

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* Arranged by Mr. R. Fischer.

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" 14, p. 202, C. 2, l. 27: read Capezzuoli's for Capezznoli's.
" 14, p. 202, C. 2, l. 32: read Capranika's for Capraŭika's.
" 14, p. 203, C. 2, l. 9: read Crouzel's for Cronzel's.
" 14, p. 204, C. 1, l. 38 et seq.: read **pus** for **mucus.**
" 14, p. 204, C. 2, l. 10: read Desbassin's for Derbassin's.
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Gählsuchtpulver } *Rad. curcumae pulv.,*
Gählsuchtwörteln } auch *Rad. rhei pulv.*
Gählstogpflaster — *Empl. plumb. comp.*
Gähl-Wundsalbe — *Ungt. basilic.*
Gänseblumen — *Flor. bellidis.*
Gänsefuss — *Herb. potentillae.*
Gänsepappel — *Malva vulgaris.*
Gänserich — *Herb. potentillae.*
Galante — *Rhiz. galangae.*
Galapp — *Rad. jalapae.*
Galgan — *Rhiz. galangae.*
Galgennägel — *Flor. cassiae.*
Galitzenstein, blau — *Cupr. sulfuric.*
" weiss — *Zinc. sulfuric.*
Galläpfel — *Gallae.*
Gallenkraut — *Herb. gratiolae.*
Gallenwurzel — *Rad. jalapae.*
Gallerjahn — *Rad. galangae,* auch *Rad. valerianae.*
Gallipot — *Resina pini burgund.*
Galmei — *Lap. calamin. praep.*
Galmeipflaster — *Empl. fuscum.*